

MY BREATHING SYSTEM



By

LIEUT. J. P. MULLER
THREE SHILLINGS & SIXPENCE

DEDICATED
TO THE BRITISH BOY
THAT HE MAY BECOME
A STRONG AND
HEALTHY ATHLETE

Yours truly
VP Mullen
1927.



MY BREATHING SYSTEM

BY

LIEUT. J. P. MULLER, K.D.

Author of "My System," "My System for Ladies," "My System for Children," "The Daily Five Minutes," "My Sunbathing and Fresh Air System," "My Army and Navy System," etc.

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THE AUTHOR'S PREFACE TO THE FIRST EDITION

It may be a matter of surprise to some that I should add yet another volume to the already lengthy Catalogue of booklets of "The Art of Breathing." In justification I must state that my first reason is, that I have hitherto found all such works to be too much of the nature of text-books on the so called "art"; hence it is now my ambition to bring forward a common-sense book on Breathing.

And my second reason is that, notwithstanding the scores of older books on breathing, we still meet thousands of persons who are unable to breathe properly: not only children and women, but even sportsmen, singers and scientific men. And thousands and thousands still die of consumption, notwithstanding the fact that this could be prevented merely by teaching the children proper breathing. There is, therefore, still much to be done in this direction.

That I have succeeded in my object is vouched for by the following unsolicited letter from:—

DR. JAMES SWANSON, M.A., M.B., C.M., F.F.P.S.,
Glasgow, Professor at St. Mungo's College, University of Glasgow.

DEAR LIEUT. MULLER,

I am much obliged for your book on Breathing. Deep breathing is strongly recommended by all Physical Culturists, but the methods adopted are not always productive of good results. I have no hesitation in saying that anyone who carefully and faithfully follows the methods advised in your book will receive much benefit. I am sure also that you will secure the hearty co-operation of the medical profession in your good work.

I have no hesitation in saying that no living man has done more to promote a clean, healthy life among the men and women of England than you have done.

I wish you long life and strength to continue your good work of salvation by attention to the body.

With good wishes,

Yours faithfully,

(Signed) JAMES SWANSON.

Further evidence than that of Dr. J. Swanson is unnecessary.

J. P. MULLER.

THE AUTHOR'S PREFACE TO THE THIRD EDITION

Since the first edition was published, I have had numerous proofs that my theories on breathing are right and my practical hints and tips useful. Nearly 600 British Medical Men have admitted this fact—amongst them, some well known specialists in diseases of the heart, lungs and throat. And during the War, the Air Ministry sent out, to all concerned, a memorandum, wherein it was recommended that my advice on breathing should be followed especially as to how to breathe at great altitudes.

One of the most striking proofs of the importance of correct breathing, for the proper action of the organs situated *below* the diaphragm also, is the number of cases of young military men who, not withstanding their physical drill and athletic games, suffered from constipation and other digestive troubles, caused by the wrong habit of keeping the abdomen indrawn and rigid, and so, muscle-bound. As soon as they learned to relax the abdomen and to move the lower ribs freely in full respirations during exercise, the ailments disappeared. In some cases, even operations were thus prevented.

Another experience of mine during recent years is that the *vertical* expansion and contraction of the thorax—the “concertinalike” up and down movement—is much more important for easy, but full, respiration than I realised or anticipated when this book was first published.

It is a most curious fact, therefore, in my opinion that this natural method of increased respiration is not even mentioned in the most commonly used text-books on Physiology.

I was also the first to realize and prove that deep exhalation is still more important than full inhalation; and that the exhalation can be made deeper and yet easier, if the abdominal wall be relaxed, so that it shall not impede the contraction of the ribs.

The old wrong method of deep exhalation, with inwards drawing and even contraction of the abdominal muscles, is, unfortunately, still too often being taught, even by scientists in the universities.

J. P. MULLER.

Tring, Herts.,

January

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MY BREATHING SYSTEM

PART I

CHAPTER I

WHAT DEEP-BREATHING EXERCISES ARE

EVERYBODY knows that without air we cannot exist more than a few minutes, but we can exist for at least a week without water, while people have fasted from food for from forty to seventy days and even longer. Air is a nutriment, therefore, of even more importance than liquid and solid foods; yet it is remarkable that the majority of people devote so much consideration to what they eat and drink and so little to what or how they breathe.

The element contained in the air we breathe which is of prime necessity to our existence is oxygen. Protoplasm, which is the physical basis of life, the substance of which all the cells which form the body are composed, is continually undergoing chemical change, which change of matter is known as metabolism—complex substances are built up from simple ones, which are in turn broken up; the chemical energy of the food brought to the cells is transformed into the energy of motion, heat, etc. Without Oxygen, protoplasm cannot exist; and an insufficient supply hinders metabolism. Once this is understood, the reason why metabolic diseases (gout, rheumatism, obesity, anæmia, chlorosis, jaundice, diabetes) are common is evident.

How then can we inflate and empty the lungs to their utmost limits? Only by exercise, and by learning, during such exercise, to breathe in a correct manner. Of course everybody *does* breathe after a fashion, otherwise they

would die. But few understand how to breathe, inhale and exhale, correctly.

Is "Natural" Breathing always Correct Breathing?

I have often read in books on "Breathing" that babies and animals breathe correctly. There may be some reason in using the term "correctly," because it is natural for unintelligent creatures to breathe in such a manner, but a baby's breathing is very short and superficial, even when lying still, consisting of 42 to 45 respirations in a minute. And probably everyone has observed what quick and short breaths the average horse takes when running; that however, means an overstraining, and premature wearing out of some of the machinery. And the average horse is, notoriously, a short-lived animal.

The Evils of Short and Shallow Breathing.

In superficial and short respiration one portion of the lungs is used too much, and thereby overstrained, whilst another part, through disuse, loses by degrees its working capacity. The destructive effects of short respiration are not limited to the lungs alone. They affect the whole circulation, and, what is worst of all, the heart. It is a well known fact that the need for air is increased by hard physical work or exertion. It is, therefore, obvious that the breathings, if short, must be more rapid and more frequent in order to secure a sufficient supply of air. Scientists reckon that the heart has a tendency to beat 4 times to each respiration. If, then, the respirations of a horse, or of a badly trained athlete, reach the number, say, of 140 per minute—which is not unusual—this means that the heart attempts to beat 560 times! But this is an impossibility, and the result will then be a very irregular pulsation of the heart, the one beat stumbling "on the heels" of the other,

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and violent palpitations. Such an overstrained heart could never last long.

Deep-Breathing must be Taught.

We cannot teach animals to breathe deeply but we can teach the child to do so, little by little, and even the adult human being. Then by degrees it will become natural to the person to take fuller respirations. Such education in breathing means increased strength and vitality of all parts of the body, internal and external, and, consequently a fuller and better and longer life, which is the aim of all so-called deep-breathing exercises. In my first book, "My System, 15 Minutes' Work a Day for Health's Sake," I conclude the chapter "*For those devoted to Athletic Sports*" with the following remarks:—

"Many sportsmen also upset their hearts because they take no care to breathe properly. At the Olympic Games of 1906, it appeared that nearly all the participants, excepting the Americans, suffered from dilatation or other defects of the heart. Those who carry out My System according to directions will acquire the good habit of inhaling and exhaling deeply, during the exercises, as well as immediately after them. The reason why I have been able to take part, for a whole generation, in many and various hard and often protracted contests, without inflicting the slightest injury upon my heart, is because I have always from childhood paid strict attention to correct respiration."

During recent years severely adverse criticisms of the manner in which the Olympic Games are now being conducted have frequently appeared in newspapers in all parts of the world. One of the most serious objections is that the aim of them is to produce specialists who, being splendidly developed in one direction or in some particular part of the

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body, lack that harmony of all-round development which is so essential to health and a long happy life.

Under present conditions, thousands of athletes, training for these Games, are injuring their vital organs, especially the heart, because they indulge in strenuous one-sided exercises, without possessing a body which has been uniformly strengthened within and without by proper physical education in accordance with sound hygienic principles.

To insist on an age limit for competitors is, of course, a very paltry device which relieves the controllers of the Games of a good deal of responsibility. But such a course will not obviate failure, because athletes who are too young to enter will simply continue their erroneous methods of training, meanwhile entering for other competitions until old enough to participate in the Olympic Games. Besides which, the age limit involves great injustice to youngsters educated and trained in accordance with sound principles, and who are, therefore, fully capable of competing with any adult.

The only sensible measure would be to encourage the healthy all-round development of all children, young people and aspiring athletes, the aim of which development would be above all to invigorate the vital organs in the thoracic and abdominal cavities, further to develop the trunk muscles before paying too much attention to the arm and leg muscles, and to transform the skin into a hardened, properly functioning organ.

And the only way possible to attain such hygienic development is by means of individual daily physical gymnastics, the best way to encourage which would be to include in the Olympic Games' programme a competition for practical systems of so-called home gymnastics.

Now that there are indications that the Swedish authorities are no longer to be called upon to determine what kind

of gymnastics are to be competed for, or demonstrated at the Games, realisation of this hygienic proposal is within the range of possibility, in which event, there would be a cessation of carping from those critics who recognise that all-round hygienic development ought to be the basis of all games and sports, and is, therefore, much more important than many of the strange competitions which now disfigure the programme of the Games, the only drawback being that the compiler of the winning system of "home gymnastics" would probably win such fame and wealth as to excite envy.

How the average Athlete and Oarsman strain Heart and Lungs.

It is estimated by Professor Zuntz that an adult man respires 16 to 18 times per minute. It is also asserted that the average number of pulsations of the heart should be 64 to 72 for a man in a state of rest (viz., 4 by 16 to 4 by 18). But this German professor proceeds to state that during severe exertion this number of respirations are multiplied several times, during ordinary walking, 2 to 4 times; while cycling, mountaineering, and running, 9 to 13 times; and while rowing the course at racing speed ($1\frac{1}{4}$ mile in 8 minutes) 20 times. I have seen much faulty breathing amongst athletes generally; but if this statement of Professor Zuntz is according to fact, it is much worse than I ever dreamt of. Twenty times 16 is 320 respirations per minute. And this again means that the heart strives to attain 1,280 pulsations per minute! What wonder that so many promising athletes have ruined their heart and their health!

I am now (1914) over forty-seven years old, and have taken part in rowing regattas for twenty-nine years, but hitherto I have never met an oarsman who could pull harder and with more endurance than myself. The reason is that from an early age I cultivated a full, and proportionately

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slow, regular respiration, even during the hardest and most protracted efforts. As long as I am under 28 strokes per minute, I take two breaths to each stroke (if racing, of course; during paddling, never more than one breath). But if I make over 28 strokes, I only take one breath per stroke. Therefore, the highest number of respirations per minute will be 56. This is vastly different from 230! And the pulsations of my heart, which, according to theory, should strive to reach the number of 224, will practically never be more than 180 even in the hardest spurts. (This number does not, of course, represent a whole minute's work but, there being 30 beats in the first ten seconds after the finish of a spurt, this corresponds to 180 per minute. A sound heart will rapidly regain normal beat, pulsating at the end of the first 60 seconds at a rate of say, 160 beats per minute, and at the end of the second minute even only 120.)

The German doctor, Professor Kolb, himself at one time a prominent oarsman, found the heart of the rowing athlete to beat 230 to 250 times per minute after only one minute's hard work. This rate is not so alarming as Professor Zuntz's theoretical figures would lead us to anticipate. Above the limit of health, it can only be assumed that the respiration of these men was too rapid and shallow.

Why Deep-breathing Exercises have latterly fallen into Discredit

The question of the usefulness or the harmfulness of deep-breathing exercises has of late been keenly discussed, even in the daily papers. It is very likely that the opponents of such exercises have had discouraging experience themselves, or have witnessed very poor results amongst their friends. I have myself now and then met people whose chest or lungs were defective, notwithstanding that they had worked hard for the purpose of strengthening these important organs of

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the body. But one thing is quite certain: when deep-breathing exercises have given bad results, then the method has been a wrong one. There are three classes of people



FIG. 1. A WRONG METHOD OF DEEP-BREATHING.
Photograph of the Author, taken about 25 years ago, when he did not possess so much knowledge and experience as now.

amongst whom we may be sure of meeting the melastic "cropper chest," veiling an incipient or already developed emphysema or even heart disease. Let me cite the case of the Swedish gymnasts, of whom I shall have occasion to speak in a later chapter: the victims of military drill; and the so-called "strong men."

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One of the most common regulations for soldiers is : Chest outwards, " stomach " inwards !—the tight belt, or the officer's corset, helping considerably to secure this unnatural posture. Soldiers drilled, they are exhorted to arch the chest more and more, and to keep this up permanently. That is called deep-breathing exercise ! And the officers think it their duty to set the soldiers an example. They hardly dare to make a fair exhalation, for fear the chest should sink. This foolish practice continued for years, the ribs become fixed and rigid, the vesicles slack and permanently distended, like old misused indiarubber ; in other words, the lungs are ruined.

Here is illustrated two distinct faults : firstly, the strongly indrawn abdomen, as a result of which the viscera prevent the diaphragm from sinking and, therefore, the breath from being a full one ; secondly, the lack of deep exhalation, the effect of which may be the above-named lung and heart troubles. It is, therefore, not only wrong, but in the long run also dangerous, always to walk about with the chest too highly arched and the abdomen too much drawn in. The natural easy bearing of the body seen in the ancient Greek statues is the healthiest and most beautiful—at all events in the eyes of those who have a properly developed taste. But I am sure that if a Swedish gymnastic teacher or a military drill sergeant were to visit the museum and contemplate, not from the front, but in profile, an *Apoxyomenos*, a *Doryphoros*, or an *Apollo Belvedere*, they would declare these superb figures round-backed and flat-chested.

Samples of the third class, the " strong men," are found among those who pose and are photographed in the most unnatural and overstrained attitudes. As mentioned on p. 72, it becomes quite habitual to performers of " feats of strength " after inhalation to arch the chest and brace all the muscles of the trunk, especially the abdominal, while

they hold their breath. By degrees they become firm believers in the false theory that this is the right method of deep-breathing, and that the highly inflated upper chest and deeply drawn abdomen (See Fig. 1) are the very symbols of imposing, superhuman strength.

Should the Breath ever be held after a Deep Inhalation ?

Books on " Deep-Breathing " and " Breathing for Health " there are in which every single exercise is breath-holding, combined with some movements of the limbs. There may be cases where the holding of the breath for a minute or more might be a useful exercise calculated to increase the control of lungs and heart. Setting aside certain occasions of urgency (*e.g.*, when diving and rescuing drowning persons), this should never be combined with feats of exertion, and can only be recommended to healthy and well-trained adults whose vital organs are sound. To those who are suffering from consumption, asthma, and heart diseases the practice is dangerous. And even overtrained athletes or muscle-bound weight-lifters who imagine themselves to be so strong and healthy should, above all things, avoid holding the breath. It is this habit, combined with over-inflation of the lungs, which is responsible for emphysema or heart disease ; hence the reason why I do not advocate any breath-holding exercise. It must also be remembered that it is not only the action of the lungs and heart which is disturbed by holding the breath. What stimulates the stomach, liver, bowels and intestines is just the internal massage produced by the movements of the lower ribs and the diaphragm, when full, deep, correct breathing is performed. The lack of such stimulus will soon cause stomach troubles and digestive disorders.

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The Importance of Physical Exercise immediately before Deep-Breathing.

In scores of books in all languages deep-breathing is recommended, and always prescribed in the same manner, namely, that in the early morning one should stand in front of an open window and perform a long series of very full respirations, more often than not combined with holding of the breath—but nothing else.

Many years ago, in my first book, "My System," I maintained that it was a wrong idea to stand quietly and take deep breaths without any previous physical exertion. And all my considerable experience since that time has convinced me that I was right. It is always a healthy practice in daily life to take fairly deep and regular breaths, but the special full respirations, whereby large quantities of air are pumped into the lungs, should never be performed unless the body really needs this extra supply; otherwise derangement in the relative pressure of the vessels of the body will be caused, the equilibrium in the tissues will be disturbed, and giddiness and dizziness result. On the other hand, the deep breaths will be more complete, will be performed more easily, and give more comfort, if combined with some form of bodily exercise or physical exertion requiring increased change of air in the lungs.

If such exercise only lasts a short time, we should utilise the opportunity and take some deep breaths immediately after it. The exercise of longer duration, one should perform deep-breathing continuously during the movements.

Beginners in the art of breathing unacquainted with gymnastic exercise, may profitably practise deep-breathing when walking to or from their business. They should take 4 to 5 strides during inhalation and 5 to 7 during exhalation. After some practice the number of strides may be augmented. But there should always be some more strides during

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exhalation than during inhalation. The lungs stronger, it is an excellent plan to run a few hundred yards, and then walk and perform a number of breathings, which now will naturally be very full. Then repeat the run and the walk, with deep-breathing, several times.

The reason why so many "inventors" of special deep-breathing exercises recommend holding the breath, sometimes for a rather long period, is to create a desire for more air. They realise that it is not easy to breathe very fully unless such need exists. But instead of producing this effect in a natural way, by good bodily exercise, they suggest holding the breath. It is undoubtedly true that one is forced to take several full respirations after having held the breath for a minute or more ; but if one does not possess a strong heart to start with, the organ will certainly be injured.

The Importance of Slow Exhalation.

Full inhalation depends on deep exhalation, but the opposite relation does not exist. If one has taken a very long and deep exhalation, one is bound to follow this with a full inhalation, otherwise there results a sensation of being smothered. But after a full inhalation one experiences no special impulse to perform an exhalation of a corresponding quality or quantity. Hence the prime importance of exhaling. Many people cultivate an inadequate method of inhaling, a sort of constant inflation of the lungs, with an exaggerated arching of the chest, which eventually may result in the production of emphysema. Full inhalation often comes quite naturally as the result of predisposing conditions, *e.g.*, after muscular effort ; but deep exhalation must be specifically learnt. A good deep exhalation demands a certain amount of time, and should, therefore,

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always be performed rather slowly. Reference to "My System" will show that I always recommend the practice of slow exhalation during the performance of the muscular and gymnastic exercises, and of the rubbing movements as well, even in cases where I sometimes prescribe a rather brisk inhalation. And I adhere, of course, to the same principle in this booklet. The scientific reason for such slow performance of exhalation is as follows:—

The walls of each of the four hundred millions of vesicles in the lungs are constructed of elastic fibres. But this elasticity will in time be lost if the fibres are expanded too much or too often *without giving them sufficient time to contract again*. This is exactly the case with ordinary india-rubber when it is misused. If the vesicles are always filled with air by full inhalations, and if they are never given sufficient time to contract and again expel the air by deep and slow exhalations, the result will be by degrees a morbid slackness of the fibres. When it is remembered that during deflation each of the several millions of vesicles of the lungs has to contract to about one-third of its capacity when distended, it will be readily understood that a considerable amount of time is requisite for the process. The reader may have met athletic-looking weight-lifters or gymnasts or "strong men" with chests as high, broad and arched as a barrel. Some may have admired or even coveted these barrels. But in most cases such chests are but "white sepulchres." The ribs have become practically immovable, and the vesicles of the lungs have lost their elasticity. Such a chest will be unable to stand a protracted effort without injuring the heart, and emphysema of the lungs itself will probably cause premature death of the individual. Therefore the ideal should be a movable thorax and elastic vesicles, trained just as much by steady contraction as by expansion.

Why should we Breathe through the Nose?

Nature gave us a mouth with which to eat and to speak, and a nose with which to breathe and to smell. We are told that "the breath of life was breathed into man's nostrils"—then why should he not continue to live by breathing through the same channels? The higher animals always breathe through the nostrils. Such "over-domesticated" or degenerate creatures as the pet dog and the fussy, breathless hen are the only exceptions to the general rule. Considered as animals, many human beings also are degenerate, and use their organs in a perverted way, *e.g.*, the mouth for breathing purposes. If we examine the internal structure of the nose, we shall see at once that it was Nature's intention that inhaled air should pass through this channel. The entrance to the nostrils is furnished with hairs, and farther inwards, the nasal cavities are entirely lined with mucous membrane. Most of the dust, germs, and impure particles which enter during the act of inhalation are retained here, and the air is thus cleansed, whilst if the air is inhaled through the mouth, more micro-organisms pass into the lungs. Especially in cases where the tonsils have been removed by operation, the direct entrance to the bronchi and lungs is quite open. In big towns, where the air is always foul, the mucous membrane of the nose has a very hard task to perform, and must, therefore, secrete a plentiful supply of mucus, which will run or drip away from the nostrils. This process is therefore by no means always a sign of cold, but only proof that the protecting organs are performing their duty thoroughly. In some big centres the air is so bad and the smoke so dense that it is impossible for the mucous membrane to arrest all the dust and germs, some of which will, therefore, pass through the throat and reach the bronchi; but if these organs are healthy, they will react

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against the invasion and throw off the germs, which are ejected with the phlegm in the act of expectoration. This sort of coughing, also, is not at all due to any ailment or cold, but is actually a proof of the sound condition of the organs. On the other hand, unhealthy persons who are without reactive power will retain and store up, day after day, year after year, all this poisonous matter within their system, which becomes consequently steadily weakened. It is a good habit to cleanse the mucous membrane and the throat each morning or night with a solution of common salt in warm water. When the throat is gargled with this in the usual manner, much phlegm and black substances from the inhaled town air will be dissolved and brought up. The nose is easily cleansed by means of some of the salt water held in the hollow of the hand, then snuffed up into the nose, and finally expelled through the mouth.

If persons who have decayed teeth inhale through the mouth they will never get fresh air into their lungs, even when visiting the seaside. The inhaled air will be constantly infected by the putrid secretions of the mouth. And when they exhale through the mouth, they will poison the air for their fellow-beings.

Another advantage of nasal breathing is that we become immediately warned, through the sense of smell of the presence in a room of poisonous gases, or of air which contains dangerous impurities, whilst those who breathe through the mouth as a rule have the nostrils obstructed and have impaired, or totally lost, their sense of smell. These people are quickly suffocated in the case of an escape of gas, or slowly poisoned if working at dangerous occupations, as in the case of compositors, painters, plumbers, pottery workers, etc., who are particularly liable to lead-poisoning.

Especially in cold weather is it of great importance that

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the inhaled air should be well warmed before it enters the lungs. This heating cannot take place adequately unless the air is inhaled through the nose. Many chills and inflammations arise solely from the fact that the air inhaled through the mouth is too cold for the bronchi and the mucous membrane of the lungs. Now, the interior of the nose is splendidly arranged as a feed-heater. There are one small and two big pieces of muscle or cartilage in the inner cavity of the nose, and between these are three irregularly formed passages, the walls of which are entirely covered with mucous membrane filled with warm blood, which thus constitute a very large heating-surface. The air during inhalation is dispersed over this large surface, and the irregularity of the walls of the passages prevents it from rushing through too quickly. By this means even very cold air is heated to a temperature not much below that of the body. At the same time this inrush of fresh air forms a most effective massage for the mucous membrane. If it be deprived of this massage, as is the case with mouth-breathers, the membrane will degenerate and become the seat of chronic catarrh or of adenoids, a species of tumour or growth of the lymphatic tissues of the upper part of the throat, especially prevalent in children. The presence of which condition may be detected by the fact that the child suffers from chronic nasal catarrh, and breathes through the mouth, which is usually held open. The obstruction and consequences give the child a stupid, sluggish look. Adenoids occur chiefly in children from four to fourteen years, but very young children have been known to suffer from them. Being morbid growths they are always due to ill-conditions of the mucous membrane, and that is why all children should be taught from infancy to breathe through the nose. This may be achieved by the mother taking great care to close the baby's lips whenever it is

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asleep. The infant will soon acquire the habit and be benefited thereby.

The most effective cure for adenoids is that of surgical removal and is in nearly all cases a very simple and not dangerous operation.



FIG. 2.—THE CORRECT MANNER OF OPENING THE
NOSTRILS WHEN INHALING

Besides which, the duty of the nasal mucous membrane is not only to heat the inhaled air, but also to moisten it, or saturate it with vapour. This process is also unsatisfactorily performed if the air makes a short cut through the mouth. The mucus of the nose, in the act of secreting the

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vapour, becomes transformed in dry weather into hard crusts. Therefore the air in rooms heated by radiators etc., is often very uncomfortable. Flat basins of water should be placed on the top of such stoves, in order to supply the air with sufficient moisture.



FIG. 3. THE WRONG MANNER OF EXHALING, BY SUCKING IN AIR, AND THEREBY CLOSING THE NOSTRILS

There is still another great advantage in breathing through the nose, namely, that one obviates all the risks of making one's throat dry and husky by the continual friction of the air on the back of the throat. Especially in dry weather, or when the air is filled with dust, the mouth breather will

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suffer from an almost unquenchable thirst. This produces a habit of excessive drinking—a practice which is liable to injure not alone the pocket, but also the health.

The reasons, then, for nasal breathing are many and weighty, and this method ought, therefore, to be adopted as much as possible. In a later chapter, "Hints for Athletes," I mention some cases where it is, unfortunately, necessary to breathe through the mouth. But it is then the more important for these athletes to adopt the normal nasal method both by day and night, whenever they are not occupied in their special sport. Moreover, there is also an æsthetic reason why we should breathe through the nose. Running about with an open mouth always imparts an idiotic appearance. In Denmark we say of such an individual, that "he resembles a cod-fish in rainy weather."

Many persons at first find it difficult to obtain sufficient air through the nose. Very often the reason is that they close the "wings" of the nostrils instead of distending them. They don't know that in order to get air into the lungs, it is sufficient simply to open the nose and expand the thorax, which, by creating a vacuum inside, will force the air to rush in. They imagine that the air must be sucked in, and that such sniffing should be performed with as big a noise as possible. But by this suction the wings of the nose, and the outer walls a little higher up as well will be drawn inwards and pressed against the middle wall of the nose, and the nostrils be thus closed. The wings and outer walls of the nose consist of muscles, which should be trained so that they are able to move outwards and thereby give free and almost soundless passage to the air. Many persons nowadays have lost their ability to move these muscles. But after a few weeks' practice it is in most cases possible to regain this power. Fig 2 shows a well-opened nose, whilst Fig. 3 shows how the nostrils are closed when the air is

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sucked in. For persons who find it very difficult to acquire this control of the nostrils I can recommend practice of it before a mirror every time they have a few minutes to spare.

Why is it generally Wrong to Exhale through the Mouth after Nasal Inhalation?

In a letter I received some time ago from an officer of the Royal Navy, I was asked why in "My System" I recommended both inhaling and exhaling through the nose. The writer thought I was wrong, and he stated further, that "the Swedish system as taught in the Navy tells those who practise it to inhale through the nose and exhale through the mouth." I have often been asked the same question by German readers, probably because so many German books on gymnastics recommend this wrong method. Lieutenant Hébert, the author of the new French "System," has also fallen into this error (see p. 217 of "L'éducation physique"), and into many other errors as well. Let me now, therefore, answer the question fully, for once and all. Perhaps the most practical way to convince a man who follows this method that he is wrong would be to let him practise it during a hard ski-ing trip up and down the mountains, or when speed-skating a fair distance in a temperature of that sort in which the breath freezes and settles as rime on the beard and eyebrows, and upon the front of the jacket. He would certainly soon feel as if that ornament of the face we call the nose were completely missing, as it would be frozen white both inside and outside; and if he did not quickly rub it with snow he would soon lose it in reality. The reason for this is, that the man, having steadily inhaled ice-cold air, would, at the same time, have lost all opportunity of again heating the frozen mucous membrane by the aid of warm exhaled air, since he had allowed it to escape through his mouth.

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When the mucous membrane of the nose has become too cold, it is no longer able to heat the supply of cold air which is inhaled in the ensuing breath. Cold air will then enter down into the lungs and produce colds and perhaps pneumonia.

A similar danger may be incurred even during the summer, if the air is very dry. Not alone the mucous membrane of the nose, but also that of the lungs, will then become too dry and irritated and no longer capable of resisting the attacking germs. The only means of preventing this is to allow the exhaled air, which is always saturated with vapour, to pass away through the nose instead of through the mouth.

There is still a third reason why exhaling through the mouth is wrong. If there are bacilli or other dangerous organisms in the air—and this is always the case in railway compartments, and even in the open air of big centres—many of these germs will be arrested at various stages by the mucous membrane. But if there is a regular, steady draught downwards, some of these bacilli or germs will, owing to the absence of an expiratory current, certainly travel farther and farther inwards. This will happen if inhalation is always made through the nose and exhalation through the mouth. But if there occur every alternate instant a current of air in the opposite direction, *i.e.*, if exhalation be performed through the nose, a number of the germs will be expelled again. In the absence, also, of this outward passage of air, paroxysmal attacks of sneezing, which at times may be very persistent and most distressing to the sufferer, are induced by Nature's efforts to get rid of the obstructing or irritating particles.

Fourthly, I have reason, arising out of my personal experience, for recommending exhalation through the nose. As readers of my former books will have remarked, I always recommend comparatively slow exhalation. Now, if we

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exhale through the nose, we are bound to do it slowly. But if exhalation is performed through the mouth, it is possible to do it very quickly by a sort of "puff." And it is my experience that beginners in the art of breathing nearly always succumb to the temptation of exhaling in this seemingly easy manner, if they are ever allowed to use the mouth for this purpose.

A fifth reason I find in a booklet by Dr. Halls Dally. He calls it a grievous error to breathe in through the nose and out through the mouth; "The pupils subsequently may become confused as to the direction, and breathe in through the mouth and out through the nose. This has happened not infrequently within my own experience."

Shut your Mouth !

Recently a friend of mine lent me an old book, "Shut your mouth, and Save your life," by George Catlin, London, 1875. It is out of print, but ought to be reprinted. The author studied the life of Indian tribes in North and South America. He found sanitary conditions among these savage races much better than among civilised races, and during his investigations he was more and more convinced that the reason was that the Indians always breathed through their nose, not only in the daytime, but also when sleeping. They were taught to do so as babies, their Indian mothers always closing their children's lips when the latter were asleep.

I should like to make a few quotations from this sane old work :—

"All persons going to sleep should think, not of their business, not of their riches or poverty, their pains or their pleasures, but of, what are of infinitely greater importance to them, their lungs; their best friends, that have kept them alive through the day, and from whose quiet and

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peaceful repose they are to look for happiness and strength during the toils of the following day. They should first recollect that their natural food is fresh air; and next, that the channels prepared for the supply of that food are the nostrils, which are supplied with the means of purifying the food for the lungs, as the mouth is constructed to select and masticate the food for the stomach. The lungs should be put to rest as a fond mother lulls her infant to sleep; they should be supplied with vital air, and protected in the natural use of it; and for such care, each successive day would repay in increased pleasures and enjoyments. . . ."

"It is the suppression of saliva, with dryness of the mouth, an unnatural current of cold air across the teeth and gums during the hours of sleep, that produces malformation of the teeth, toothache, and tic-douloureux, with premature decay and loss of teeth, so lamentably prevalent in the civilised world. . . ."

"It is, most undoubtedly, the above-named habit which produces confirmed snorers, and also consumption of the lungs and many other diseases, as well as premature decay of the teeth, nightmare, etc.; from which, it has been shown, the savage races are chiefly exempt; and (I firmly believe) from the fact that they always sleep with their mouths closed, and their teeth together, as I have before described. . . ."

"Open mouths during the night are sure to produce open mouths during the day; the teeth protrude if the habit be commenced in infancy so that the mouth can't be shut, the natural expression is lost, the voice is affected, polypus takes possession of the nose, the teeth decay, tainted breath ensues, and the lungs are destroyed. The whole features of the face are changed, the under jaw, unhinged, falls and retires, the cheeks are hollowed, and the cheek-bones and

the upper jaw advance, and the brow and the upper eyelids are unnaturally lifted; presenting at once the leading features and expression of IDIOCY."

It is quite true what the author just quoted remarks on the snoring habit being produced by breathing through the open mouth. The reason is that the inspired and expelled draughts of air strike against the uvula and soft palate, setting them in vibration and giving forth anything but a musical sound. While it is better for the habitual nose-breather to have the pillow as low as possible, I should advise that a child, while being trained to breathe only through the nose, should have its pillow arranged at such a height and so placed (under the head and not under the shoulders) that the head will be kept well raised when the child lies on its back, for if the head is too far back there is a tendency for the jaw to drop open.

Laughter—A Healthy Method of Exhaling

is hearty laughter which makes "one's sides ache," as the people say. It is, therefore, a splendid thing for the health to see a good comedy played, or the antics of a clown, and it would be healthier still if these things were not, as is, unfortunately, nearly always the case, indissolubly connected with foul air and late hours.

Laughing is produced by a sort of exhalation in gusts, in the production of which the abdominal wall is alternately braced and relaxed.

The healthy effect is partly direct, by shaking and massaging of the viscera; partly indirect, by creating good spirits, which promotes metabolism.

Let us, therefore, enjoy a good laugh as often as we have the opportunity.

CHAPTER II.

THE MACHINERY OF THE BREATHING APPARATUS.

A FULL explanation of the anatomy of the breathing organs is unnecessary here. I will content myself with dealing only with the mechanism involved, briefly outlining the functions which occur during the respiratory process, with a view to correcting some common errors which are prevalent concerning the matter.

Fig. 4 shows the human trunk opened in front so that most of the internal organs are visible, and Fig. 5 gives a skeleton-like side-view. The whole inner cavity is divided by a horizontal, but dome-shaped, partition-wall (the diaphragm) into an upper part (the thoracic compartment), containing the lungs and heart, and a lower part (the abdominal compartment), containing the liver, gall-bladder, stomach, kidneys, intestines, etc. Now it is obvious that the more the thorax is enlarged and expanded in various directions, the more fully can the lungs, by inhalation, be inflated with fresh air, rich in oxygen. And, on the other hand, the more the thorax, during exhalation, can be contracted and narrowed, the greater amount of foul air, containing carbonic acid, that will be expelled from the lungs.

What Constitutes a Respiration?

One inhalation or inspiration, and one exhalation or expiration, constitutes one breath, or respiration. Inhalation and exhalation will always follow alternately upon each

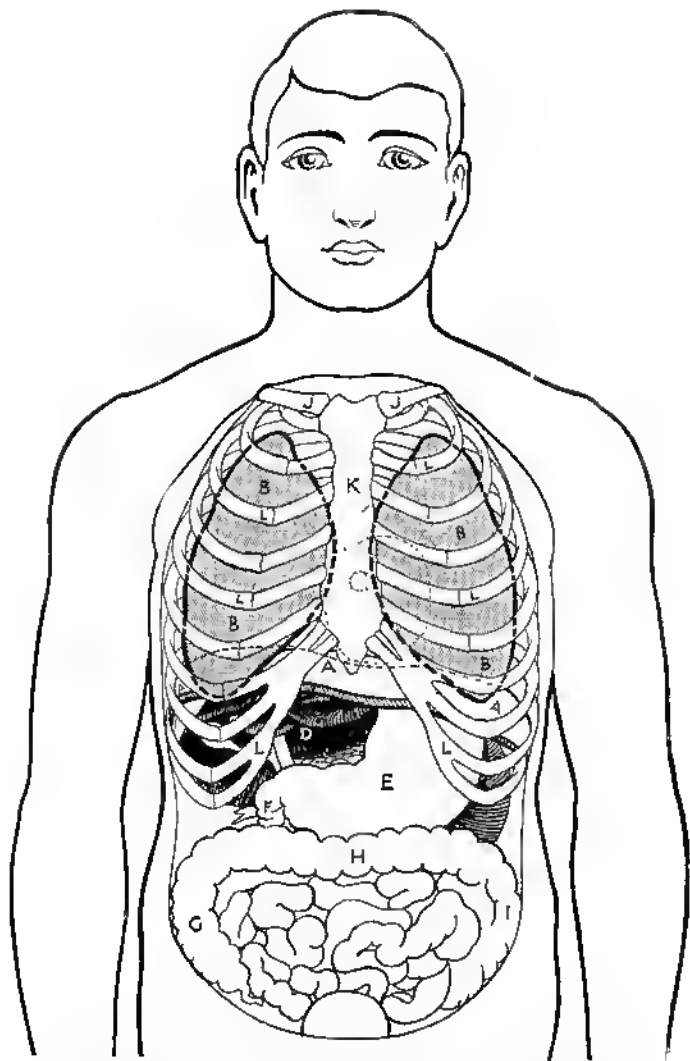


FIG. 1.—FRONT VIEW OF INTERIOR OF THE HUMAN TRUNK
 A—Diaphragm B—Lungs. C—Heart D—Liver. E—Stomach.
 F—Pylorus G, H, I—Colon J—Collar Bones. K—Breast Bone. L—Ribs

other in a definite space of time, and on the greater or shorter duration of these periods depends what we call the measure or rhythm of respiration. When the individual is in a state of rest, there is no need for any great change of air in the lungs, and it will then be sufficient to take comparatively small or incomplete respirations in slow measure. But as soon as the individual begins to move or work, much more air is needed, and the more the effort is augmented the greater will become the necessity of supplying the lungs abundantly with fresh air, and of getting rid of the vitiated air, since all the chemical processes involved grow intensive to a degree corresponding with the physical effort. The individual is thus forced to take as complete breaths as possible, and these in much quicker measure. If, now, he is unable to expand and contract the thorax and lungs sufficiently to enable the requisite change of air to take place, he will get "out of breath," succumb to the effort, and, if these conditions are long sustained, the vital organs will be injured. It is, then, very important for every human being, even for persons of sedentary life, to develop and maintain the elasticity of the respiratory organs, because nobody knows when the moment may arrive when great exertion may be demanded of these organs. Unfortunately many people cannot take what I call a complete breath. Either they do not know how to do it, or they may be physically unable to do it. In the first case it is easily acquired after a little steady and sustained practice, whilst in the latter case it will, of course, take a much longer time to develop the working power of the breathing organs. Still, it is always possible to do this, except in cases of advanced tuberculosis or very old-standing emphysema, or asthma.

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How to Expand and Contract the Thorax to its fullest Extent

The thoracic cavity can be widened during inhalation, and, of course, again narrowed, during exhalation, in three diameters, or in six different directions. There is vertical expansion both upwards and downwards, and horizontal expansion in four directions, namely, to the left and right sides, to the front and backwards.

Fig. 6 (an orthodiagram by Dr. Halls Dally) shows how the thoracic cavity is increased upwards, the collar bones and the shoulders being lifted. The altered position of the nipples shows that all the ribs and the breastbone have also been raised. At the same time the diaphragm has been considerably depressed, the result being a downward increase of the thoracic cavity. The transverse or lateral expansion to both sides, right and left, is also clearly shown in Fig. 6. It is greatest in the region of the lower ribs, because these are much more movable than the upper ones. In the case of a well-developed athlete, both the upward and the sideways expansion will be much greater.

When the ribs are raised and moved outwards sideways, they together with the breastbone (sternum), are simultaneously brought somewhat forward. This constitutes the expansion of the thorax to the front (see Fig. 7). The work of moving the ribs is performed mainly by several small muscles placed upon, between, and inside the ribs (intercostal muscles and serratus major). The large breast muscles, or pectorals, do not share at all in the work of breathing; on the contrary, if overdeveloped, *e.g.*, by exercise on the parallel bars, they will tend to check the elasticity of the thorax. It is, therefore, from the point of view of breathing, foolish to attempt to build up a chest of muscle instead of enlarging the cavity and increasing the elasticity of the lungs.

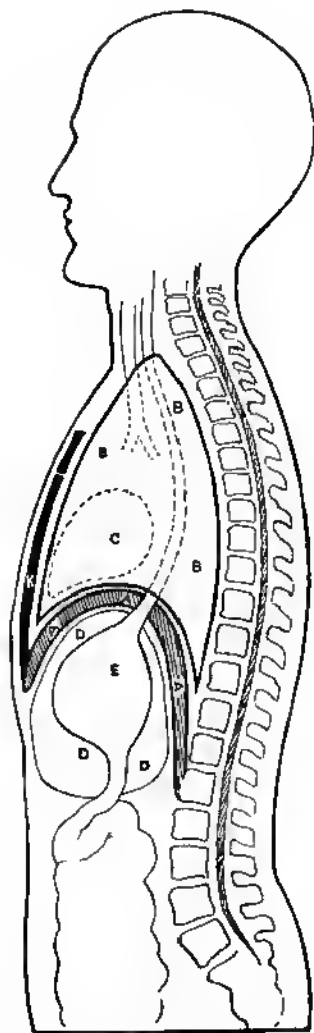


FIG. 5.—SKELETON-LIKE SIDE VIEW OF TRUNK
 A—Diaphragm. B—Lungs. C—Heart. D—Liver. E—Stomach
 K—Breast Bone.

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Finally, we have the horizontal backward expansion, forming the sixth direction in which an enlargement of the

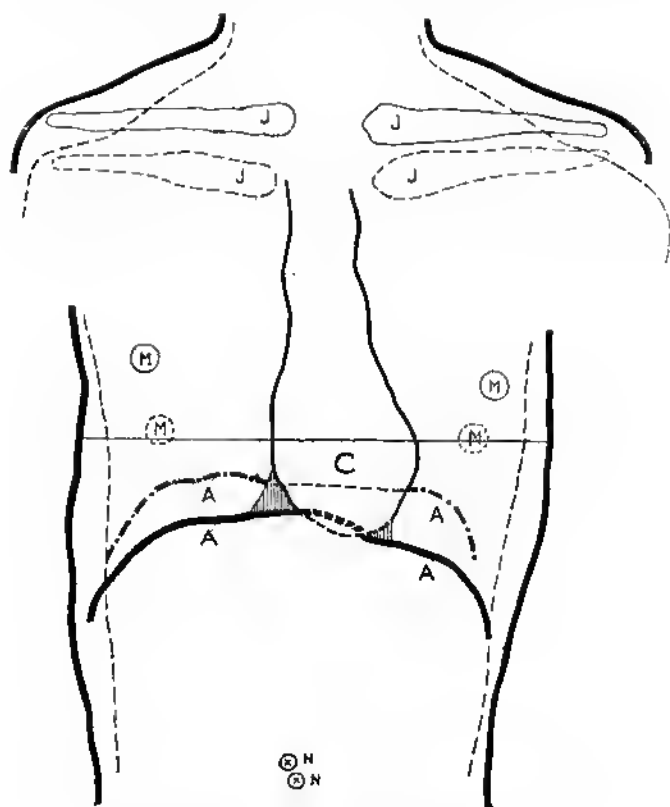


FIG. 6.-ORTHODIAGRAM BY DR. HALLS DALLY

(Black lines : Inhalation. Dotted lines : Exhalation)

A Diaphragm. C Heart J Collar Bones. M Nipples.
N Navel

thoracic cavity is possible. It is performed by a backward movement of the whole upper and middle part of the spine (see Fig. 8). It was Dr. J. F. Halls Dally who, first of all,

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scientifically established this fact. He said, in a recent lecture: "I can find no reference to this movement in eight



FIG. 7.

The horizontal expansion to the front and backwards during inhalation (plotted lines)

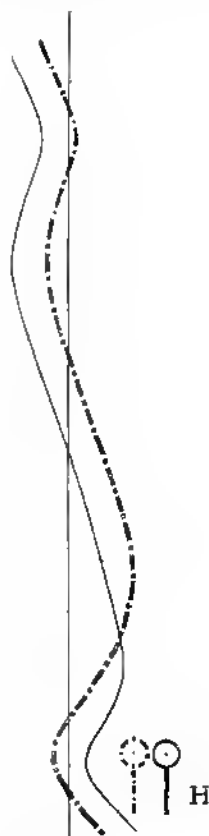


FIG. 8.

The backward movement of the spine during inhalation (continuous black line) according to Dr. Halls Daily. H Hip Joint

of the latest and best known text-books of physiology. That this movement is actual and of mechanical advantage

in breathing can be verified by visual and orthodiagraphic examination. . . . Throughout inspiration there is a backward spinal movement which is of importance in securing maximum aeration of the lungs." This fact, hitherto quite ignored, is fully explained by Dr. Halls Dally in "An Inquiry into the Physiological Mechanism of Respiration, with especial reference to the Movements of the Vertebral Column and Diaphragm." (*Journ. Anat. and Physiol.* Vol. XLIII., 1908, p. 93 ; v. also *Proc. Roy. Soc.*, Feb. B., Vol. LXXX., 1908.)

The thoracic cavity is again diminished, and exhalation thus performed, when the chest contracts all over, and the diaphragm ascends (see the dotted lines of Figs. 6 and 8). The lowering of the shoulders and collar-bones is caused simply by their own weight, whilst the downward and inward movement of the ribs, sternum and spine, in ordinary breathing, is caused partly by the weight of the bones and partly by the elasticity of the whole thorax, when the inspiration muscles relax. But when deep-breathing is concerned, the ribs should, by definite muscular force, be pressed further downwards and inwards. The result will be a triple profit : Firstly, a much larger amount of the vitiated supplemental air will be driven out of the lungs by each exhalation ; secondly, the small vesicles of the lungs will get an opportunity of contracting to a fair degree, thereby retaining their elasticity, and, thirdly, the ribs will not grow rigid, but the thorax will retain or still further increase its mobility.

Which of these Six Different Expansions are the most effectual in promoting Free Access of Air to the Lungs ?

Opinions upon this point vary greatly. Some authors, like Dr. H. H. Hulbert, maintain that the horizontal, lateral

expansion alone gives the best result, others, like the French lieutenant, Georges Hébert, assert that this is attained only by the diaphragmatic movements. In order to prove their theories, these authors point out that the lower lobes of the lungs are larger than the upper lobes. Again, there are others who try to convince us that the antero-posterioral expansions are of greater value than the lateral. And, finally, there are some who claim just the same for the vertical expansion of the collar-bone region, even going so far as to declare that the thorough practice of this movement would result in the complete prevention of the tuberculosis plague.

The whole argument is not of much value, because the fact remains that absolutely none of the various expansions can be dispensed with if complete respiration is to be performed. On the other hand, it may be of some interest to institute a comparison. I would, therefore, point out that vertical expansion will, in a well-developed male, extend to about 2 inches upwards and another 2 inches downwards, four in all - and horizontal lateral expansion would be about the same, namely, 2 inches to each side, whilst antero-posterioral expansion will very seldom amount to more than $1\frac{1}{2}$ inches in all. The backward movement of the spine will always be small, never more than $\frac{1}{2}$ inch.

Is it ever Reasonable to Perform an Incomplete Breath?

It seems quite obvious that for the healthy-working human being, especially for athletes, sportsmen and singers, the only sensible thing would be to employ the whole capacity of the lungs when breathing. Nevertheless, it is a fact, although incomprehensible, that so many authors of booklets on breathing and singing advocate the use of one single part only, or of a few parts, of the respiratory mechanism.

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simultaneously severely condemning the use of all the rest. Sometimes exclusive abdominal or diaphragmatic breathing is esteemed the only saving method; sometimes the so-called lateral costal breathing; now the upper costal and now the inferior costal method; now and then the clavicular or collar-bone form of breathing.

It is only in the case of defects or ailments of the chest that certain special parts of the lungs should be favoured, either with a view to developing such defective parts, or because it would be dangerous to use any part of the lung that may have been injured.

As to abdominal breathing, it is true that this is almost sufficient when one is sleeping, or when sitting bent over the writing-desk, or when reading in the easy chair, because in such cases the need of air, or rather of change of gases, is only very small. But as soon as one moves, more air is immediately needed, and it will then be of advantage to employ the entire thorax. And if this has grown rigid and immovable, so much the worse for its possessor. A German arm-chair philosopher has found that of 490 cubic centimetres of air inhaled, only 170 are due to the movement of the diaphragm and 320 to the expansion of the chest. I should think it must have been his own defective respiratory faculty which he measured, because I am sure that the above-mentioned proportion in a well-developed athlete or oarsman, who can inhale 6,000 cubic centimetres, would be a still stronger argument for thoracic expansion. It was formerly a common view that the abdominal form of breathing was the natural one for men, the upper chest form for women. But this view is quite erroneous and only caused by bad habit. When the lower ribs and the whole abdomen are laced immovably in a corset, the woman is, of course, compelled to restrict herself to the employment of the upper chest method alone. And it is for the purpose of repairing

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the harm done by such old habits that special exercise of "abdominal" breathing is most valuable for ladies. And it is because it also constitutes a valuable massage of all the viscera, and further strengthens the abdominal muscles and increases the ability of controlling them, that I have introduced such an exercise as No. 9 into my "Five Minutes' Breathing System." We speak popularly, when performing this special breathing, of filling the "stomach" or the abdomen with air; but the air will, of course, only fill up the lower lobes of the lungs, as a result of the thoracic cavity having been enlarged downwards by the descent of the diaphragm. What actually in this case causes the protrusion of the abdomen is, of course, the descent of the viscera, which are allowed to sink down and forwards inside the distended abdominal wall. And this lowering of the viscera will facilitate the descent of the diaphragm, thereby making this "abdominal" breath fuller. During the corresponding exhalation, the abdominal wall is drawn inwards as much as possible, and the intestines are again pressed inwards and upwards, whereby the now relaxed diaphragm is assisted in its ascent.

Another example of a reasonable incomplete breath is explained in my hints for boxers (on p. 110). Almost the whole costal part of the breathing is in this case checked, because the breast-bone and the ribs especially the lower ones, are fixed by the braced abdominal muscles. Breathing in this case must be carried on mainly by the aid of the vertical movements of the clavicular region and of the diaphragm. Again, gymnasts who climb ropes by the hands only, or perform hanging tricks on the trapeze, the Roman rings, or horizontal bar, are dependent on this special method of respiration, if they breathe at all during the performance. But in most cases they will be found holding their breath, thereby endangering their vital organs. Also

when we spend our time in crowded halls in poisonous air, or are forced to stay in badly ventilated rooms, it is wise to use an incomplete breath, thus respiring as superficially and lightly as possible. Thus we inhale only the smallest possible amount of poisons into our bodies. As soon as we come outside into the open air, we should, of course compensate by breathing very fully.

Physical exercise performed in foul air is worse than no exercise at all, because we inhale about sixteen times more air and, of course, poisons in proportion, when exercising than when resting.

The Secret of the Diaphragm.

Science has not yet been able to unveil this secret. Nobody on earth knows exactly what the diaphragm can perform. Most text-books are, so far as this matter is concerned, full of nonsense. Let me remind the reader that the diaphragm consists of a central tendon surrounded by muscle fibres, forming two domes, of which that on the right side of the body is the larger and higher (see Fig. 6 on p. 37). The exterior parts of these muscle fibres are firmly attached all round—at the sides to the inside of the lower ribs, in front to the breastbone, and to the spine behind. As typical examples of prevalent ideas on this subject, I give below some quotations from books by English and German experts, and I will show that these ideas are wrong. I will then refer to the investigations of Dr. Halls Dally, and, finally, explain my own theory.

In "Breathing for Voice Production" (1903), by H. H. Hulbert, B.A. (Oxon.), M.R.C.S., L.R.C.P., etc., on p. 7. appears the following:

"Writers and teachers, taking note only of the action of the diaphragm in which the tendon descends when the ribs are fixed, usually make the erroneous statement, *that the ribs*

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can be elevated and the diaphragm depressed at one and the same time. This is physically impossible."

Dr. Hulbert is here quite wrong. It is not only possible to raise the ribs and lower the diaphragm simultaneously, but this does always actually occur when a correct complete inhalation is taken. See for instance, Fig. 6 on p. 37, where the X-rays clearly show the diaphragm being depressed some inches, whilst the clavicles and the nipples—and thus also the ribs—are raised some inches in the opposite direction.

On p. 14 the author says: "The arched muscular floor of the thorax is formed by the diaphragm, which becomes flattened when it contracts, and so it increases the size of the thorax from above downwards. If the diaphragm is unresisted during contraction it depresses the contents of the abdomen and pushes forward its anterior wall: if, on the other hand, it is resisted by the contracted abdominal muscles, the stomach and liver are firmly fixed against the under part of the dome-shaped partition. So that, when it contracts, the diaphragm raises the chest and expands the ribs TRANSVERSELY."

Here there are as many mistakes as there are sentences. Firstly, if the abdominal muscles are contracted or braced, it is impossible to expand the ribs.¹ And secondly, even if it were possible, how could it be performed by the diaphragm which is attached to the *inside* of all the lower ribs? If the diaphragm contracts, *i.e.*, shortens its muscle fibres, it will, of course, bring the ribs nearer to each other and thereby narrow the chest. When the ribs are really widened and the chest raised during inhalation, this must certainly be the result of a force stronger than the diaphragm itself.

And further, on p. 15: "How, then, do we gain the greatest expansion of lung, and how can we best control

¹ On the other hand, this is easy if the abdominal wall is only drawn inwards, but that does not constitute the movement necessary for controlling the voice.

our breathing ? " The author (Dr. Hulbert) submits that this is accomplished by fixing the diaphragm THROUGH THE ACTION OF THE ABDOMINAL MUSCLES ; for, by this method, the lower ribs are most efficiently raised.

And, on p. 26 : " By drawing in the front wall of the abdomen, the organs are fixed in the arch of the diaphragm. This is the FIRST STEP TO BE TAKEN IN LATERAL COSTAL BREATHING."

Here once more Dr. Hulbert is wrong. If we simply draw in the front wall of the abdomen, the descent of the diaphragm is impeded, and we shall not get the lower lobes of the lungs fully inflated ; and, if we contract or brace this abdominal wall, it will be quite impossible to raise the lower ribs, and we shall never get a full breath. It is so simple that everybody can try it on himself. On p. 9, Dr. Hulbert gives a quotation from an " authoritative " anatomical work, Quain's " TEXT-BOOK OF ANATOMY." Let me quote a few passages from this work :—

" The action of the diaphragm is more easily understood than that of the intercostal muscles. By its contraction and descent its convexity is diminished, the abdominal viscera are pressed downward, and the thorax expanded vertically. The fibres arising from the ribs, being directed nearly vertically upwards from their origins, must tend to raise those ribs : and Duchenne has shown that the contraction of the diaphragm by itself elevates and expands the ribs to which it is attached, but only so long as the vault of the muscle is supported by the abdominal viscera ; for, when they are removed, it no longer has that action. . . . The keynote of the position is in the action of the diaphragm described by Duchenne, who has shown that the *contraction of the diaphragm by itself elevates and expands the ribs to which it is attached so long as the vault of the muscle is supported by the abdominal viscera.*"

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Further, on p. 13, Dr. Hulbert writes: " By this method of breathing—which we will henceforth call the *Lateral Costal* method—the contracted abdominal muscles fix the stomach and liver in the arch of the diaphragm, so that in its contraction it expands and raises the chest during inspiration. . . . It is maintained by the author (Dr. Hulbert) that this is the explanation of the method used by the old Italian School, in which it was taught that the abdominal wall should be *slightly retracted*—that is, that the abdominal muscles should be contracted, and the vault of the diaphragm supported, and that a full inspiration be taken, by which the diaphragm raises and expands the chest."

Let us investigate these curious assertions. It is said that the fibres of the diaphragm, arising from the ribs, are directed nearly vertically upwards from their origins, and, therefore, they should be able to raise and expand the ribs. Firstly, as to the faculty of raising the ribs, this could be understood if the diaphragm were really stationary. But as shown in Fig. 6, on p. 37, the diaphragm descends about 2 inches at the same time as the ribs are raised another 2 inches. Seen from the standpoint of the ribs, the diaphragm thus sinks about 4 inches. How then, is it possible to imagine that it is the diaphragm which has effected the elevation of the ribs? At all events, not unless it was done by the aid of a mechanism of pulleys! But such a mechanism does not exist. Secondly, as to the expanding of the ribs, I have already proved that a diaphragm, which shortens its muscular fibres, will always have a tendency to contract the ribs, never of expanding them, because it is attached to the inside of them. Further, let us see what sort of " support " the abdominal viscera should be able to give the vault or tendon of the diaphragmatic muscle. Can the reader imagine the viscera being harder or stronger than an iron chain or a thick string? Well, it is a fact that some men

are so strong that they are able to break a chain, put around the chest, by expanding the ribs. According to the fallacious theory cited above it is the diaphragm which extends the ribs, which implies that the liver and stomach must be as hard as stone: for, as they do not give way, the poor chain has to go! That the conception of the viscera acting as a firm support for the working diaphragm is nonsense is obvious when one remembers that the diaphragm descends each time that the ribs are expanded during inhalation, and thus exerts a downward pressure upon the always soft viscera. (The abdomen then protrudes a little, but when the ribs, during further inhalation, are raised and expanded still more, the skin is, of course, tightened and the abdominal wall somewhat flattened.)

In German books we find precisely similar wrong ideas concerning the diaphragm. For instance, in Dr. Keller-Hoerschelmann's "*Mein Atmungssystem*," pp. 44 and 45: "Let us first consider Inspiration. By the contraction of the diaphragm the thorax is expanded in such a manner that the ribs are raised, and that outwards, but only so long as the viscera fill the abdomen. If the resistance of the viscera is lacking—then the ribs will contract. . . . The diaphragm needs the support of the viscera to be able to raise and expand the ribs. But if strong abdominal muscles are present, these will brace themselves without contracting, and will furnish the abdominal cavity, at the sides and to the front, with firm walls which will not give way. When the viscera are thus unable to escape, they must themselves withstand the pressure, and are somewhat compressed, whereby they make a firm support for raising and expanding the ribs." The same description is found verbatim in Dr. Paul Jaerschky's "*Koerperpflege*," pp. 39-40. What a laboured method of explaining the simple process of inhalation!

Dr. J. F. Halls Dally on the Diaphragm.

For thirteen years Dr. Halls Dally has been engaged in investigating the subject of respiration, both in human beings and animals. He has come nearer the truth than any other living man of science. Amongst other things, he proved that the old theory as to the flattening of the diaphragmatic domes is pure fancy. He found that they move up and down after the fashion of a piston. In his clinical lecture, "Respiration in Health and Disease," he says (p. 12) the following concerning the movement of the diaphragm:—

"For any adequate description of this movement you will consult in vain most of the standard works on physiology. Until the present date most of these works state that during inspiration the central tendon of the diaphragm remains fixed, while the domes flatten in descent, this supposed action being illustrated in many cases by imaginative diagrams. In point of fact no such action takes place. It is true that on orthodiagraphic examination in subjects with well-developed diaphragmatic descent, a slight depression is sometimes seen just external to the summit of the right dome, this being due to the strong downward pull of the right crus; and that in some people with marked raising of the lower ribs the convexity of the dome represents the arc of a slightly larger circle than it does in expiration; but with these minor exceptions, which I only mention for the sake of completeness, it is incorrect to state that any flattening of the domes occurs. As I pointed out in 1903, the curve of the convexity on each side is unaltered in descent, and each half—although attached to its fellow of the opposite side by the central tendon—by means of its own separate innervation through the phrenic nerve, acts quite independently . . ."

Again, "This second movement (a raising and lateral movement of the lower set of ribs) is also caused by the

diaphragm, which, having by this time descended until its central tendon exerts firm continuous pressure upon the intra-abdominal viscera, now executes the second part of its dual action in contracting its ring of costal fibres. These, being attached at an oblique angle to the ribs, in contraction raise the ribs upwards and outwards, being aided by the external intercostals and intercartilaginous portions of the internal intercostals."

As we may see, Dr. Halls Dally has not quite emancipated himself from the old theory of the diaphragm as a rib-moving power. The explanation is, I think, that the X-ray photographs and orthodiagrams certainly give an exact illustration of facts, but they do not tell us anything about the cause and effect of what we see.

My Own Theories about the Diaphragm.

When we breathe very quietly—for instance, when resting or sleeping—the diaphragm "pulsates" on its own account, and that quite unconsciously, in a manner similar to the beating of the heart. In this case the slight contractions and relaxations of the diaphragm form, in many persons, almost the only motive power of their breathing. But when more change of air is needed, part or the whole of the thorax expands and contracts, moved by muscles which, in well-developed individuals, are much stronger than the diaphragm. Even if it still continue its own small "pulsations," the diaphragm is now, as a whole, forced to give way to the movements of the lower ribs and sternum, to which it is attached. It will be easily understood that, when the ribs are brought nearer to each other, the whole middle part of the diaphragm will move upwards; and when the ribs are moved away from each other, this central portion of the diaphragm will sink, even though the ribs are at the same time somewhat raised. It is only the outer annular border or margin of the

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diaphragm which is brought into a nearly vertical position when the ribs are contracted, and into an almost horizontal position when the ribs are expanded and raised, whilst the central part, including the domes, will move up and down without materially altering its shape. The skeleton-like Fig. 9 shows these movements. When the points *A* and *B* of the ribs move outwards and upwards to *a* and *b* respec-

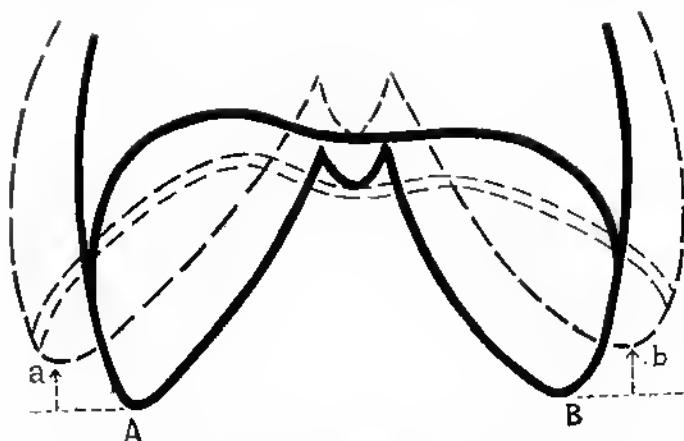


FIG. 9.—SKELETON-LIKE ILLUSTRATION OF THE WAY IN WHICH THE RIBS MOVE THE DIAPHRAGM, ACCORDING TO THE AUTHOR'S THEORY

tively, the domes will sink, but are quite able to keep their shape.

In the photographs of Fig. 10, a quite practical demonstration is given of the relation between the movements of ribs and diaphragm respectively. Any reader possessing a carpenter's rule can try this experiment for himself, and thus become convinced of the soundness of my theory, which explains these movements in accordance with natural laws, whilst all former theories are at variance with these laws.

The muscles which move the ribs are the various intercostal muscles and the serratus major.

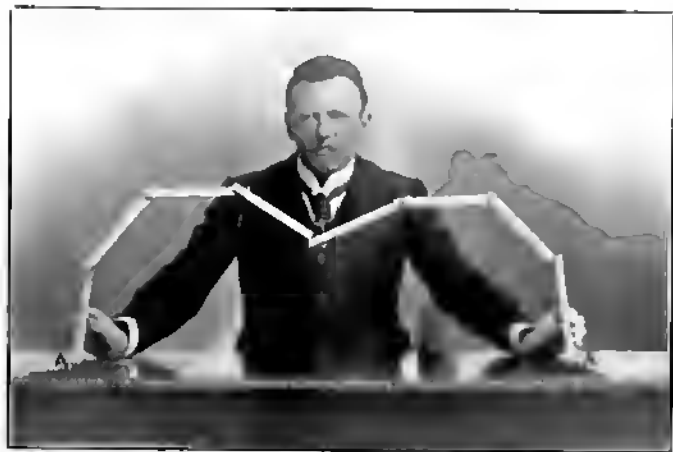


FIG. 10. A PRACTICAL DEMONSTRATION OF THE
AUTHOR'S THEORY AS TO THE MOVEMENTS
OF THE DIAPHRAGM

When A A representing the lowest points of the ribs rise to B B, the whole middle part of the carpenter's rule (representing the domes of the diaphragm) must sink.

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I think there exists a good deal of superstition about the diaphragm, this mysterious organ, which nevertheless, every man in the street, in his own fancy, knows just as well as his pocket.

I am convinced that it is quite impossible to move the diaphragm separately, intentionally or voluntarily, although, of course, we move it indirectly by moving the ribs or the abdominal muscles. It would be easier to believe, as is asserted, that certain Hindus are able to arrest the pulsation of their hearts for a short period, because we can locate the heart both by feeling and by hearing it. And in such cases it is easier to get a connection of nerve between the brain and the organ in question. But the diaphragm cannot be perceived through any of our senses, and I, therefore, maintain it is impossible to establish direct nervous contact with it. I know that many people will assert that such movements as are illustrated in Figs. 44 and 45 are caused by the diaphragm; but it is impossible to explain how the diaphragm can achieve such results. And there is surely no reason why the diaphragm should perform a thing which is easily done by the abdominal muscles. The diaphragm is a quietly and unconsciously working breathing muscle. But it is easy to perform the movements of Figs. 44 and 45, without breathing; or even when breathing in the exactly opposite way, as shown in Figs. 11 and 12, where Fig. 11 represents the fullest possible inhalation, and Fig. 12 the exhalation.

The direct proof of the fact that nobody can move his diaphragm voluntarily, or come into direct nervous contact with it, is that all the sensations which people imagine that they have in the diaphragm are always actually in the abdominal wall, or perhaps in the stomach or intestines. If you ask a person to point out where he thinks his diaphragm is, he will, in nine cases out of ten, put his finger near the

navel, or at all events not higher than on a level with the openings of the lower pockets of his waistcoat. But the diaphragm is really situated much higher on the front of the chest, above the point of the breastbone (see Fig. 5 on p. 36), that is, on a level with the upper pockets of the waistcoat.

On the other hand, it is quite possible *indirectly* to stop the breathing activity of the diaphragm, namely, when the breath is being held ; which is done by stopping the passage of air through the trachea, the abdominal wall often assisting in the performance by creating a counter-pressure when braced. But it is by no means certain that movements of the diaphragm will always result in breathing. It is possible to hold the breath and simultaneously by muscular force to move the ribs, and thereby the diaphragm, to the utmost limits ; in other words, to perform very large but " void " respiratory movements without letting the slightest amount of air pass in or out.

Further, I have met several elderly military men whose ribs, breastbone and spine had grown quite rigid, thereby rendering the whole thorax absolutely immovable. During many years they had breathed only by using the diaphragm. One would suppose that this would, in consequence, have grown very strong, because every muscle which is much used develops. But why, then, was the diaphragm muscle in these cases not able to contract the ribs ? If, after all, it was at any time possible for the diaphragm to move the ribs, it should surely have occurred in such cases of very strong and practised diaphragms.

I know very well that experiments have been performed in which the diaphragm was paralysed by injection, after which it turned out that the ribs could not be moved so much as before. This was regarded as a proof that it was the diaphragm which moved the ribs. But in my opinion this phenomenon may be explained as follows :—



FIG. 44—A WOMAN, PRE-ARREST POSITION.



FIG. 45—A WOMAN, POST-ARREST POSITION.

FIGS. 44 and 45 show the effect a person has after absolute respiration.

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When the diaphragm is not paralysed it readily follows the movement of the ribs; but if it be it will hang on to the ribs as a dead weight, hindering their movements.

It is, after all, not the laity alone who imagine that the diaphragm is a voluntary muscle. For instance, recently I found, in the *British Medical Journal*, of August 30th, 1913, the following sentence in the report of the sub-committee for voice training, appointed by the University of London: "Breathing for voice, as contrasted with the breathing of repose, which is automatic and mainly diaphragmatic, presents certain new factors. Of these the employment of the diaphragm as a voluntary muscle is probably the most important.

"When the diaphragm acts in this way, in addition to its descent, which is the more obvious result, the lower ribs are elevated, increasing the transverse diameter of the body at this level, thus providing additional space at that part of the abdominal cavity for the viscera displaced by the descent of the diaphragm."

This somewhat vaguely expressed quotation seems still further to suggest that it is the diaphragm which in this case elevates the lower ribs.

Before ending this chapter, I would remark that the diaphragm, of course, does not always act as the only breathing muscle in sleeping or resting persons. In women, healthy children and athletes, in other words in persons with an elastic thorax and well-trained breathing muscles between the ribs and round the collar bones, these muscles will continue their work subconsciously during sleep and rest, but naturally not very conspicuously, owing to the decreased need of aeration of the lungs.

CHAPTER III

THE VARIOUS METHODS OF TAKING A COMPLETE BREATH

Description of my Ordinary Complete Breath (or the Relieving Deep-Breathing Exercise).

THE best breath is that which, in the easiest and most natural way, with the least strain of muscle or conscious effort, and in the shortest space of time, gives the largest supply of fresh air and the most complete expulsion of vitiated air. My ordinary complete breath has already been explained in the various editions of "My System," for men, for ladies, and for children. All the experience I have had since I wrote my first book, and all my later theoretical studies and practical examinations of thousands of living human beings, have confirmed my conviction that "my complete breath" is the most efficacious and, at the same time, the easiest form of deep-breathing. And being also the quickest manner of completely inflating the lungs, it is the most useful for athletes and sportsmen. I will now describe it still more fully than I did in my earlier works :

Stand erect, with the body well balanced upon the whole of your feet. The hands should rest on the hips, the shoulders thus being partly relieved of the weight of the arms. Lean the head very slightly back. Open the nostrils as wide as possible. Raise the lower ribs as far as possible outwards, and that chiefly to the sides, but also somewhat to the front, together with the breastbone. At the same time stretch the whole upper part of the trunk upwards, and continue this stretching and lifting for a while after the lower ribs have been completely expanded. The air will then rush in and fill every part of the lungs. This combined lifting and

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widening of the thorax resembles, to some extent, the movements of an umbrella whose cover is loose on the stick. When we open it a little, the cover will at the same time slip up towards the ferrule, which in this comparison represents our head, the stick representing our neck, the latter being thus apparently shortened. The inflation of the lungs is performed quite automatically, owing to the vacuum which is created in the interior. Hence it is quite wrong to suppose that by sniffing or sucking more air can be inhaled. On the contrary, this will probably cause a partial closing of the nostrils since the air, when sniffed in, will have a tendency to drive the wings and outer walls of the nose into contact with the middle wall. If the inhalation is accompanied with a loud noise, then you may be sure that the nostrils are not opened so widely as they ought to be. Fig. 2 on p. 24 shows the nostrils well widened, whilst Fig. 3 shows how the same nostrils are closed by sucking or sniffing. It is a good practice to stand before a mirror and exercise the small muscles which move the "wings" of the nose.

It is a great mistake, during this inhalation, to force the elbows and shoulders backwards and to bring the upper part of the chest into a cramped and highly arched position. It is too hard a strain compared with the result it gives. The air space of the chest is only shifted and not increased thereby. The upper lobes of the lungs will be filled in an easy and gentle manner simply by the above mentioned stretching of the trunk with *lifting* of shoulders and clavicles.

It is absolutely wrong in this, my complete breath, to move the abdominal wall intentionally. It should be kept quite relaxed, in a natural position. It is a mistake to make a conscious effort to ensure diaphragmatic or abdominal co-operation in the complete breath. This will come quite unconsciously, because the diaphragm sinks when the ribs



FIG. 13. The subject after exposure.
Front View



FIG. 14. The subject after exposure.
Front View

Note the difference in the transverse diameter of the nasal.



FIG. 12. THE CORRECT POSTURE FOR EXERCISES.
TOP VIEW



FIG. 13. THE CORRECT POSTURE FOR EXERCISES.
SIDE VIEW

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are widened. The completeness of inhalation is sure to be frustrated, whether the abdomen be drawn in, or if it be distended, or if its muscles are braced in any position. In the first case, when the abdominal wall is forcibly drawn inwards (Figs. 1 and 11), the intestines are pressed back and upwards against the diaphragm, so that this muscular organ is prevented from sinking and, therefore, from doing its share in inhalation. The abdomen will naturally become more or less straightened and flattened, when the ribs are lifted and widened, according to the greater or smaller flexibility of the thorax in various individuals; but this must not be confused with a voluntary movement of the abdominal muscles. In the second case, if the abdominal wall is pushed outwards (Fig. 45) it will not be possible to lift and widen the lower ribs fully, and thus one of the most important expansions of the thorax will be checked. Thirdly, if the abdominal wall is braced, in that the muscles forming the wall are "contracted," the lower ribs will at the same moment be fixed in a more or less contracted position. The abdominal wall may be braced either when fully distended or when completely drawn inwards, or in any intermediate position; the result—fixation of the lower ribs and consequent check of expansion—will always be the same. The only cases where the abdominal muscles should be moved voluntarily during breathing are, firstly, when they are braced for protective purposes (as explained in the hints for boxers, p. 110); and, secondly, when the special abdominal breath is intended. This partial respiration is rather important for women who have worn a corset. For men I employ it only in Exercises No. 11 of "My System" and No. 9 of "My Five Minutes' Breathing System." The considerable movement of the abdomen in this case affords a very beneficial massage to all the intestines.

I now hope I have made it quite clear that during the



FIG. 17.—A WRONG POSE FOR INSPIRATION, THE SHOULDERS ONLY BEING LIFTED



FIG. 18.—SHOWN HOW THE HANDS MAY ASSIST IN THE LAST PART OF THE COMPLETE EXHALATION

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inhalation, as a part of "my complete breath," no attention should be paid to abdominal movements, and that the more care should be taken in moving the whole thorax. This is an easy thing for animals and healthy children. But many adult human beings have quite forgotten how to exercise this valuable faculty, elderly gentlemen using only a small abdominal breath, elderly ladies only a short clavicular breath. It can, however, in most cases be easily learned again. By trying it constantly during a few days the person will soon find out which nerves control the external intercostal muscles and serratus major. By practice these muscles will by degrees grow stronger, and, finally, be capable of moving the ribs and thereby the diaphragm to their utmost limit. Fig. 13 gives a front view and Fig. 15 a side view of the correct pose for inhalation. Fig. 17 shows a wrong way of lifting the shoulders without raising simultaneously the whole upper part of the trunk.

Complete *exhalation* is performed by the precisely contrary movements: lower the chin again, let the ribs and breastbone sink inwards and downwards, and the whole upper part of the trunk downwards, and continue the contraction of the lower ribs to their utmost limit. To perform the three first of these movements is a very easy matter in that the sinking is caused simply by the weight of the parts in question and by the elasticity of the whole thorax. Of course this elasticity comes into action the very moment that the muscles which expanded the thorax are relaxed. The further contraction or pressing inwards of the lower ribs, which should follow, is more difficult, and will in most cases require some practice before it can be performed. It is done by the internal intercostal muscles; but many individuals have lost the control over these, and the ribs may have grown rather stiff, in which case they can only be moved with difficulty. It is a good plan for

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beginners to assist with the hands in the following manner : Take them away from the hips and lay the palms against the lower part of the chest, the thumbs pointing upwards. A pressure, becoming gradually more severe, should then be exerted obliquely inwards against the lower ribs, thereby bringing them nearer to each other.

Abdominal action in complete exhalation will take place quite unconsciously, as it was in the corresponding part of the complete inhalation. Any special, intentional movement of the abdominal wall is also incorrect here. If it is drawn inwards (Fig. 44), it will prevent the lower ribs from being fully contracted which hindrance to a complete exhalation will not be counter-balanced to any extent by the assistance given to the ascent of the diaphragm through the upward pressure of the viscera because only the lower lobes of the lungs are emptied by this action, whereas both the lower and middle lobes will be emptied by full contraction of the ribs.

The intentional distention of the abdomen (Fig. 12) forms also a check to the complete exhalation because it fixes the ribs, and it is a quite unnecessary strain which should be omitted, because " my complete breath " should be in the nature of a relief. It is quite another matter that the relaxed abdomen will naturally and involuntarily protrude in a state of softness when the lower ribs are much contracted.

Fig. 14 gives a front view and Fig. 16 a side view of the correct pose for exhalation. Note the great difference between the positions of the lower ribs, and the different distances from the nipples to the navel, in Figs. 13 and 14 respectively. Fig. 18 shows the correct position of the palms when assisting in the last part of the complete exhalation.

I have studied scores of booklets, most of them Continental, describing hundreds of various methods of breathing.

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But I have never seen what I call " my ordinary complete breath " explained before. This is the more remarkable since it is the most natural and easy way of changing the largest possible amount of air in the lungs. And that is just what the practical sportsman, athlete, or working man requires to attain by respiration. The reason may be that all the above-mentioned booklets have been written either by indoor students of theoretical science, for whom shallow breathing has always sufficed (as distinguished from the case of the $\frac{1}{4}$ -mile runner when the winning-post has just been passed) ; or by athletic authors who lack the amount of education and study necessary for describing just what goes on in the interior of the body. Most of such authors advocate only one of the various forms of breathing, simultaneously condemning all the others.

The Hindu-Yogi Breathing.

Only twice have I seen advocated a combination of the three main forms of breathing. Let me first mention the "Yogi complete breath," as described in the Hindu-Yogi philosophical books. This is far more complicated and difficult to perform than my complete breath. In the Yogi complete breath the student is instructed first to fill the lower lobes of the lungs, pushing the abdomen forwards, then successively to push out the ribs, first the lower and then the upper ones, afterwards to protrude the upper chest and, finally, again to draw the lower part of the abdomen inwards. The exhalation is performed firstly by drawing the abdomen still farther inwards and lifting it upwards, the chest being fixed during the exhalation and not relaxed until the air is entirely exhaled, when, finally, also the abdomen is relaxed. What an amount of superfluous work for the brain and straining of muscles ! And the Yogis call it the only natural method of breathing ! Both the inhalation and the

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exhalation comprise, each of them, two abdominal movements—four in all! And to protrude the upper chest is much harder work than my upward stretching of the thorax ; furthermore, I am convinced that the latter movement is much more effective for the purpose of filling the upper lobes. And why should we fail to avail ourselves of the natural elasticity of the thorax, and the good intercostal muscles, for exhaling ? I will not deny that the Yogi books contain several good hints on hygienic matters. But it is rather difficult to find them and pick them out amongst the abundant flow of language wherein they are concealed. The Yogis have, amongst other things, three special modes of respiration, viz., " the Yogi cleansing breath," " the Yogi nerve vitalising breath," and " the Yogi vocal breath," each of them elaborately and profusely described. But I will undertake to prove to anyone who is interested that the " nerve vitalising " and the " vocal " breaths are of just as much (or as little) use for ventilating the lungs as the " cleansing " breath ; that the " vocal " and the " cleansing " breaths are just as much (or as little) stimulating to the nerves as the " nerve vitalising " breath ; or that the " cleansing " and the " nerve vitalising " breaths are of just as much (or as little) service in developing the voice as the " vocal breath." In most of the Yogi breaths instruction is given to exhale vigorously through the mouth, sometimes there is even added : " in one great breath through the wide opened mouth." That this method is wrong, and even in the long run dangerous, I have proved in the foregoing chapters. The greatest part of the Yogi philosophy consists of words, words, words. But very plausible words. I concede.

Dr. Halls Dally's "Full Cycle of Complete Respiration "

is the second combination I have found of the three main forms of breathing. He describes it himself as follows: " Following expiration, there occurs a slight passive protrusion of the anterior abdominal wall. This corresponds to the initial active contraction of the crural and sternal fibres of the diaphragm, which constitutes, as I have just said, the first act in inspiration. Next, following in even and orderly sequence, comes a raising of the lower or diaphragmatic set of ribs, together with backward expansion of the chest over the area corresponding to the lower lobes, the lateral movement being the more marked of the two. . . . The third and last movement consists in full inflation of the part of the chest corresponding to the upper or costal set of ribs, caused by the raising of these by the external intercostals and intercartilaginei, accompanied by an extension of the thoracic curvature, together with a slight backward swing of the thoracic spine as a whole. The whole of these acts, which in complete breathing glide into one another, constitute what I have termed ' the complete cycle of full inflation.' At the end of this series of movements the chest will be found to be expanded to its fullest extent in all three diameters. Thereupon the chest is deflated, the supplemental air being driven out by powerful contraction of the abdominal muscles. Thus is performed the full cycle of complete respiration."

I am satisfied that this complete breath of Dr. Halls Dally is much better than that of the Yogis. But I still think there is no real reason why we should not use all the lobes of our lungs at once and almost simultaneously. At all events, we are bound to do so as soon as we put our theoretical deep-breathing into actual practice in athletic exercises, games and sports. For this reason I recommend my own complete breath.

The Great Mistake of Swedish Drill.

As already mentioned, we ought to use the clavicular or upper-chest breathing to a high degree, in order to bring the upper lobes into activity, which is important for preventing phthisis or consumption. But it is a very serious mistake to endeavour to carry out all the deep-breathing by forward arching of the chest. Nevertheless, you will find this mistake both in the text and the diagrams of most books on Swedish gymnastics, or based on Swedish principles. A good carriage of the body is a splendid thing, but the Swedish system proves that it is possible to exaggerate the carriage to such a degree that other things of more importance are almost forgotten. The upper-chest arching is assumed to improve the carriage, and is, therefore, recommended, while the natural form of breathing is suppressed. And, even in general, respiration is the Cinderella of the Swedish system. Take, for instance, "Haandbog i Gymnastik" (Manual of Gymnastics), compiled by the "Board of Gymnastics," Copenhagen (the Board consisting of a professor of the university, two municipal doctors, a military doctor, two officers, and a gymnastic director, from the institute at Stockholm). The book, which professes to be an improvement on the Swedish system, has 476 pages, and all sorts of muscular exercises are abundantly described and illustrated. But the chapter on "breathing exercises" consists only of one very small half-page without a single illustration. In a few lines, a sort of upper-chest inhalation is described, but there is nothing at all mentioned about exhalation; the very word is not to be found in the whole book!

Considering, firstly, that the breathing is the most important factor of every kind of physical exercise and training, and, secondly, that deep exhalation is of still more importance than deep inhalation, the above-stated fact is very curious.

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I think I was the first author who prescribed exactly, in each single exercise, how and in what part of the movement the pupil should inhale, and how and where to exhale. And I was also the first to introduce the obligatory deep-breathing pause immediately after each single strenuous exercise. There are sixteen such pauses in my 15 minutes' system, while in the programme of the Swedish gymnastic "daily lessons," lasting each about forty-five minutes, there is never to be found more than one obligatory breathing exercise, and this is generally placed at the end of the lesson. Years ago, when I was a member of a class being trained by a gymnastic director (diplomaed in Stockholm), this special deep-breathing pause used to occur at the end, when we had finished the lesson by a quick sprint or "running round" in the hall, causing myriads of atoms from the layer of dust on the floor to whirl up and be inhaled in abundance! To-day the state of things is better, of course! Even the Swedish professors have learned a good deal by studying my books, and you may now sometimes meet gymnastic teachers who carefully watch the breathing of their pupils during the various phases of all the exercises performed.

All the illustrations in the above-mentioned manual of improved Swedish gymnastic show the upper chest highly arched, and, at the same time, the abdomen drawn inwards. If this is intended to show that inhalation is going on, then it utterly fails in its object, because the indrawn "stomach" will prevent the diaphragm from sinking, and thus the lower lobes of the lungs from being inflated. And if it illustrates exhalation, it is equally wrong, because the ribs should be contracted during this phase of respiration. The third alternative is to suppose that the illustrations all show the breath being held. But to do this during exercise is a serious error, which tends to injure the heart.

Proper respiration being the most essential factor in

physical culture, it is no wonder that the death-rate from consumption is so high in Sweden. We must regard the neglect of the organs of the thoracic cavity as the greatest mistake of the Swedish, or Ling's, system. without, at the same time, underrating the other mistakes, viz., the inadequate care of the skin and the neglect of the vital organs of the abdominal cavity. The Swedish system contains no rubbing exercises, no self-massage, no air bath. It is always performed in long trousers, jersey, socks and shoes, and, therefore, it is incorrectly called "gymnastics," the meaning of this word being "the art of exercising the *naked* body." The exercises, which are performed nude in Danish "open air gymnasia" and in Continental "air-and-sun bathing places" are really far more entitled to the name of "gymnastics." The same is the case with the performances in the French college of Rheims, founded by the naval officer Hébert, who, apparently with good results, has studied the French edition of my "Fresh Air Book."

The internal organs of the abdominal cavity are neglected in the Swedish system in that there are too few affective exercises acting upon these vital parts of the body. There are some simple and slow bendings and twistings of the waist-line, but they are only carried out a few times, which is far too little for keeping these organs in regular working order. The success of "My System" in this respect is, in the first place, due to the fact that the bendings and twistings are performed very strongly or quickly, and without pauses (as soon as the learner's stage is passed); further, that each of these bending and twisting movements is repeated from ten to forty times; and, finally, that "My System" contains several very effective combinations of bending and twisting, quite unknown in the Swedish system. I have met several persons, even teachers of Swedish exercises, who suffered from digestive troubles,

notwithstanding that they exercised for a whole hour almost every day. They were not healthy until they went in for *my* exercises. And I have scores of letters from Swedish officers and prominent private people, who state that they gave up their national system because it was dull and tedious and not capable of curing their various troubles, but now, after doing "My System," they are fit and well.

Thirty years ago the Swedish system was perhaps the best. But unfortunately, it was always considered by its patrons and followers as a religious institution, any alteration of which would be blasphemous. Consequently, for 100 years (the Central Institute in Stockholm was founded in 1813 by Per Henrik Ling) it has been improved only very little, and now it has naturally become antiquated. The means by which the patrons and professors of this system try to preserve its former renown, and thereby to preserve for their country the lucrative industry of producing and exporting gymnastic teachers for the whole world, are not always quite fair.

Since the appearance of "My System," the professors of Sweden have abused me personally like a pickpocket, because they realised that my system contained great dangers to their own. It is only in self-defence that, in this chapter, I have taken the opportunity of showing by scientific argument that it is an old superstition to suppose that the Swedish system is the best of all. The Swedish experts themselves like to call their system the only "*rational, scientific gymnastics*."

I think I have proved that we have here three lies in three words, just as in the old days one spoke of the "Holy Roman Empire," which was neither Holy, Roman, nor Empire.

How the Heart is often Injured.

It may be useful to discuss this matter a little further. The effects upon the lungs and heart of the various forms of bodily exercise, gymnastics, games and sports are very different. We can, in respect to these effects, distinguish between two large groups, viz., momentary, concentrated feats of strength (or of quickness), and, on the other hand, prolonged feats of strength performed in a regular measure (endurance). The first group are scarcely able to strengthen or develop the heart and lungs, and only by careful training will it be possible to avoid positive harm being done to these organs. But the second group may easily serve to develop and strengthen both heart and lungs, and only by very irrational proceeding will it be possible to do harm to the organs. This is the great difference between these two groups. Some of the worst examples of the group are: lifting of heavy weights, difficult exercises on the Roman rings, trapeze, parallel bar, etc., short and strenuous wrestling bouts; but 100-yards sprints, several passages in football, hockey and lawn-tennis, and the newer methods of short distance swimming also belong more or less to this group. Good examples of the other are: rowing and sculling, long distance running and walking, skating and ski-ing, the older methods of swimming and all well-measured gymnastic exercises with regular breathing. Some sports, *e.g.*, boxing and cycling, it is difficult to classify positively in the one or the other group. It depends upon the individual manner of working. And several other sports are doubtful—that is, they are scarcely calculated either to develop or hurt the internal organs to a degree worth mentioning. Throwing and putting weights, jumping, golf, and cricket belong, I think, to this category.

The reason why the first-mentioned group is so calculated to injure the organs is as follows. When the lifting of a very

heavy weight— or other feat approaching the limit of the individual's power—is to be performed, it is necessary to brace most of the muscles of the trunk, in order that the limbs (for instance, the arms which lift the heavy weight) may have a solid support. But during this stiffening of the trunk almost everybody will hold the breath after having taken a full inhalation. The heart will beat very quickly, because the effort of lifting will be so great. But it will receive less and less oxidised blood, because the lungs will have stopped their work when the breath is retained. The congested red face and the swelling of the neck show how the venous system has been overfilled.

When at last the effort is over, and the air is expelled from the lungs, the blood will rush suddenly into the auricles and ventricles and over-dilate the weak walls, especially on the right side, where they are thinnest. And, if often repeated, this acute dilatation of the heart may become chronic.

This bad form of enlargement of the heart should not be confounded with that sort of enlargement which arises when the muscles of the heart, or the walls themselves, are made thicker, stronger, and more elastic, as is the case when proper feats of endurance and other good games are performed in a sensible manner.

Some doctors, especially on the Continent, where the opportunity of examining healthy athletes was formerly only very limited, would call such a strong and big heart "hypertrophied." But this name ought not to be used to signify that the heart in question is diseased. It is, on the contrary, the strong and big heart of the athlete which is of the right sort, even if it is more seldom seen by doctors than the so-called "normal" heart of ordinary weak people.

I hope my readers will now understand that it is quite wrong to call a weak or diseased heart an "athlete's heart."

Even if the heart has been weakened by athletics badly performed, it is wrong to call it an "athlete's heart," because a man ceases to be an athlete the moment his organs are weak. Nevertheless, we often see this error in the daily papers. A paragraph such as the following is typical:—

"A doctor stated at the inquest to-day concerning the sudden death of a naval cadet, N.N., that he had an athlete's heart. After taking part in Swedish drill on H.M.S. X he collapsed. The parents of N.N. live at Y, and he has rowed in races for St. Z's School, where he had good health."

This example also proves that Swedish drill is not capable of curing or strengthening a weak heart, such as often has been the case with "My System." Even if this young naval cadet had formerly weakened his heart by rowing without paying attention to his breathing, it could have been strengthened by sensible free exercises, combined with correct deep-breathing—and his life would then have been spared.

Any sort of gymnastics and drill where the aim is homogeneity and simultaneousness of the movements is, moreover, everything but adequate for strengthening hearts and lungs. Such drill can, and even must, be harmful to these organs when they are weak. The reason is that it is not possible for the individual to breathe exactly in the manner and measure most natural and convenient to him. This fact is very obvious in cases where small boys are drilled together with bigger boys.

There will, naturally, be an aggravation of the evil if the ultimate aim of the drill—as that of the Swedish, for instance—be to maintain an exaggerated stiff carriage with arched chest and in-drawn abdomen, throughout the whole performance. This sort of "gymnastics," which has hitherto been deemed by the public at large and, unfortunately, by most "authorities" as well, as excellent in every

respect, may in reality prove harmful to the vital organs of individuals who are not over strong.

My exercises have already been introduced into some English public schools as morning gymnastics for health. When my exercises are thus performed by several children at the same time, I always warn teachers against borrowing from their lessons on drill that rule which insists on the strict simultaneousness of every detailed movement. Such simultaneousness may be excellent for producing discipline, attentiveness and other splendid virtues, but is of no use for promoting health; and, is, moreover, directly dangerous for children whose vital organs are not yet sufficiently strong and developed.

Does the Athlete Die Young?

(Reprinted from "The Sporting Life.")

I owe the health and strength of my 53 years first and foremost to the British athletics which I taught myself as a weakly boy from small English manuals, and seeing what enormous benefits I had derived therefrom, most years of my youth and first manhood were devoted to teaching these athletic sports to my young countrymen, and making the public and the authorities of Denmark interested in this hitherto so neglected part of their education. To-day I think I may be proud of the good results of my work, and what always makes me most happy are the many signs of gratitude from the side of my countrymen, which culminated when the Danish King made me a Knight of Dannebrog on the 25th anniversary of my first introduction of British athletics into Denmark.

During the last seven years I have lived as a welcome guest here in England, and thus had the opportunity of studying closely the effects of athletic sports and games upon the health of their followers in this country. I have

now been convinced of the fact that this "mania for exercise" is a very good thing, a most valuable asset for the British race (among other things, it won the great war!), but, on the other hand, it cannot be denied that too many thereby hurt their health and shorten their lives. The fault lies not in the "mania" itself, and it is absolutely absurd to blame the splendid sports and games as such. The causes of failure must be sought in the frequent lack of common sense during, or after, the performances.

For instance, the strong athlete who so often has beaten his competitors and the elements will sometimes grow a swollen head and think he can stand anything—even transgress the laws of hygiene and Nature. He will go round boasting how much wet clothing he can endure, how little sleep he wants, etc., etc. Alas! one day the bacilli will surprise the strong man in a temporary state of weakness, whereas the non-athlete who has been coddled from the cradle will always be over-cautious and careful and never run a risk. Further, many active, and powerful athletes suddenly settle down to a sedentary life. All the vital organs now miss the great stimulus of the daily vigorous exercise, with the result that they soon grow slack.

The former athlete indulges in the same strong and good living as before, but without proper exercise the eliminating organs are not able to do their duty in the long run, the system is by and by poisoned thoroughly, and chronic ailments develop. Whereas the non-athlete (who never lived but only vegetated) pursues his uninteresting physical career undisturbed up to an old age, and is proudly exhibited by scribes who, from time to time, make the columns of our daily papers unsafe.

By far the most failures of both old and young athletes are due to unscientific use of the vital organs, especially the heart and lungs. Teachers and trainers may be perfect

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in the tuition of all technical points of a game, but they very, very seldom teach their pupils how to breathe during exercise. A few young athletes will do it correctly by sheer instinct or subconsciously, and it is from these that the lasting champions are recruited. The rest may win some successes before they succumb to heart or lung diseases.

The most common fault is that only part of the lung is used and thus worn out too soon, while the remainder is atrophied. Simultaneously the resulting short and quick breath causes a too quick and irregular heart beat. Or the bad habit of holding the breath during efforts will cause the heart to be dilated. Or the too restricted movement of the ribs will cause the chest to grow stiff, so that the lungs, heart, and arteries will lose their elasticity, while the liver, stomach, and bowels will miss the internal massage and grow slack. Even several of the strong veteran oarsmen and athletes who die at the age of seventy would certainly have enjoyed life and games until ninety if they had understood how to keep themselves elastic and young inside.

Let me emphasize that the worst error of an athlete is to believe that Swedish gymnastics or military drill is healthy. The permanently "chest out, stomach in" superstition has ruined millions of vital organs. Two main rules for an athlete who wants to keep fit and elastic for a long life are : *Slack down the carriage, make yourself as narrow-chested as possible, and let the abdomen protrude relaxed each time you exhale the air during exercise.* You then get rid of more foul air and make room for more fresh air, and the intestines will get internal massage and more room for working.

The other rule is : *Always relax the muscles not used for the moment in the performance of a movement.* They will then follow the command of the nerves much quicker and they will keep their strength much longer. There are hundreds of

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young and old athletes with muscle-bound arms, but there are thousands with respectively muscle-bound (rigid) abdomen and chest.

During exercise the abdomen should always be kept relaxed as much as possible. There are, of course, such exceptions as the recovery in rowing, and infighting in boxing, where the abdominal muscles are either naturally much used or voluntarily made tense. Many athletes use the abdominal muscles for balancing the trunk and keeping the body upright, but this is wrong; the muscles of the flanks and lower back should be used for this purpose, so that the work of the soft, vital organs in the abdominal cavity is not interfered with.

Now, when the abdomen is kept relaxed, it will naturally flatten somewhat during inhalation when the ribs are much expanded. But during deep exhalation, when the ribs are completely contracted, the abdomen will move outwards in a state of softness —i.e., protrude—without being intentionally pushed out. Only athletes who are muscle-bound and rigid in the abdominal muscles are unable to relax these muscles, and must therefore in the beginning try to distend the abdominal wall by muscular force.

It takes sometimes weeks or months until this relaxation is learned. But any athlete who wants to have full control over the abdomen, with good digestion and proper and easy action of the bowels, must learn it. Several athletes with internal troubles, caused by a rigid and indrawn abdominal wall, have been cut open by surgeons, who removed part of the big bowel (in order to produce a "short cut," imagining this to be an improvement upon the work of the Creator). Learning to relax the abdomen would certainly have cured the trouble with less risk of life!

Several thin athletes with constantly hard, rigid, and

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conspicuously-knotted abdominal muscles believe, and make others believe, that such muscles are strong. But they may really be so weak that the whole trunk trembles when it is raised slowly from recumbent into sitting position, with feet fixed or supported. The strongest, quickest and with most staying power are those muscles which are quite soft when not used or not being voluntarily and momentarily contracted.

To have full control over the abdomen, an athlete should be able to distend it completely, and in turn draw it inwards considerably. And in both these extreme positions, and in all intermediate positions as well, he should be able to relax the muscles and in turn to contract them. It is therefore easily misunderstood when using the expression "contracted abdomen" as synonymous with "indrawn abdomen"; the muscle fibres of the abdomen can be contracted and hard even when the abdomen is utterly distended.

It is the Swedish drill, as taught in the schools and in the Army, which is responsible for the superstition that it is beautiful to have the chest constantly arched and the abdomen constantly drawn in, and for all the troubles and ailments which follow this bad habit and unnatural bearing of the body. It is certainly wrong to have a too large, distended or fat "tummy." But it is just as wrong to be hollow in this part of the anatomy. The happy medium is here, as anywhere, the healthiest state of things.

The belief that the abdomen should be drawn in when exhaling is very common, and also widespread among athletes. It is true that it is possible partly to exhale by drawing the abdomen inwards, in that the displaced intestines then press the diaphragm upwards, whereby the lower lobes of the lungs are compressed and emptied. But unfortunately the action is limited to this part of the lungs, whereas when the ribs are contracted completely both the lower and middle lobes of the lungs are emptied. Just the

drawing in of the abdomen impedes the ribs from being contracted, in that the muscles and intestines simply come in between the walls of the thorax.

We must never forget that the ideal breath for an athlete in action is the breath which causes the greatest amount of air to enter and leave the lungs in the shortest space of time. It is therefore of the utmost importance for the working athlete to use the *whole* lung, not only part of it.

Now, the lower and middle lobes are best filled and emptied by moving the ribs, and the upper lobes by simultaneously lifting the upper part of the body, collar-bones, and shoulders (but not the shoulders alone!). This last movement should be strictly vertical; to arch the chest forward and press the shoulders backward is only a muscular strain which will not bring more air into the lungs, because their air space is only shifted, not increased thereby.



LIEFT, MOTOR SKATING AT ST. MORITZ

PART II.

MY FIVE MINUTES' BREATHING SYSTEM.

Specially formulated for Overtrained Athletes, Very Delicate People, Consumptives in the First Stage and Very Weak School Children.

THERE are people who have strong muscles, enabling them to play hard games, indulge in strenuous sports or heavy weight-lifting. But they have never learned how to breathe correctly, and, therefore, they are very liable to injure their hearts and lungs just because some of their muscles, being proportionately over-developed, tend to strain the vital organs. On the other hand, if only they would learn the best method of breathing, they would be able to do much more and much better in their special game or sport.

Further, there are people who are so weak that the exercises of "My System," or "The Daily Five Minutes," would be rather too much strain if carried out at once. The most important thing for such people is certainly to get their lungs and hearts to work in the steady and regular way which it is the object of this little Breathing System to secure. They would then by degrees become prepared to take up the whole of "My System," because their circulation would be improved and their vital organs strengthened. And, furthermore, they would then find it much easier to perform "My System" than would pupils taking it up for the first time, because the exercises in this booklet are arranged with this special purpose in view.

Consumptives in the first stage especially would benefit by adopting this little system. And, what is still more im-

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portant, if everyone, from childhood, were to perform this five minutes' work daily, consumption would be entirely prevented. Statistics tell us that this dreadful disease is still responsible for more deaths than any other malady.

Nearly one-half of all deaths in the United Kingdom, between the ages of twenty-five and thirty-five, are due to consumption. It is, first and foremost, complete breathing, with special attention to the upper lobes of the lungs, which forms the most efficacious preventive. Such an exercise is repeated eighteen times in the course of the five minutes. As every doctor can tell you, it is in these upper lobes that the tuberculosis bacilli first settle and start their dangerous work. But if they are disturbed each day and blown away by a stream of fresh air, they can never triumph. And by degrees, when the individual has grown stronger, his own well-trained leucocytes will become able to dispose of every hostile germ. There is, here in Great Britain, much valuable active work done in combating consumption. But the most important means has not yet received due attention, namely, the teaching of the younger generations how to breathe correctly. This breathing system, therefore, is eminently suitable for all schools. It would only involve the spending of five minutes between two lessons. And one of the chief effects of such a little arrangement would be the checking of the "tuberculosis" plague.

It is a pity that more of our schoolmasters do not take a few lessons in the subject of Respiration, so that they may impart the same to their charges. In Great Britain, sensible ventilation of schoolrooms is being looked after to a certain degree, but in some of our old public schools, many of the buildings of which have nothing to commend them but age, there is much room for improvement. But, while the schoolboy in these venerable institutions may be compelled to breathe vitiated air while in the schoolroom, as much

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compensation as possible should be afforded him by teaching him to breathe properly when in the open air.

I am an enthusiastic supporter of all athletics, particularly those connected with running, including football and the like. The cross-country run is a particular favourite of mine, and especially healthful, but only when it is carried out under proper conditions. I know many Public School men who date heart troubles which afflict them from the days when they strove and did not spare themselves for the honour of their school or school-house, in cross-country runs or football matches. With only the "do or die" spirit to help them, they have gone forth, often after a hearty meal, and with not the slightest notion of how to breathe.

In all my experience I have rarely heard or seen any mention of a schoolmaster preparing his boys for a long country run by teaching them to breathe correctly. Luckily for the nation, the average British schoolboy, with his inherent love of sport, is a tough and healthy youngster. But the most robust heart cannot withstand the strain of a long run over rough country if it has to struggle all the while to keep pace with over-rapid pulsations of the lungs.

And last, but not least, there are all the singers and the speakers for whom it is of the utmost importance to develop the control of their lungs, and the strength and sustaining powers of their abdominal muscles.

Why is it not Good always to Maintain the same Position during Deep-Breathing?

Because it would be tiring for the body and tedious for the mind. And, furthermore, there is the risk that not every part of the lungs will be employed to its own benefit, because the various lobes of the lungs act differently according to the varied positions of the trunk. Full respirations ought,

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therefore, to be performed with the body in different positions.

At What Time of Day should we Perform this Little System?

In the morning before breakfast, immediately before the daily dip or shower, or as soon as one is partly dressed after the bath. Or in the evening just before going to bed. Or when dressing before dinner. Or at any other convenient time of the day, but not until at least one hour has elapsed since the finish of the preceding meal, and never when one is very hungry.

Hints to Beginners.

The unpractised beginner will always, during the first few days, feel somewhat sore round the waist and between the ribs, sometimes also in the shoulders and between them, and in the thighs and calves. No soreness felt, it is only a proof that he has not performed the exercises correctly. If weak people experience a sensation of giddiness, or palpitation of the heart, during the first performances, it is a certain proof that they are greatly in need of such exercises. If the practice be continued daily these symptoms will disappear after one or two weeks. The reason of the giddiness, accompanied by palpitation, is the following: the venous blood is sucked strongly from the head into the heart by the deep inhalations, and the heart is not yet sufficiently trained in the work of simultaneously supplying enough arterial blood in return.

The following nine exercises consist of full respirations performed in various positions of the body, and combined with movements of the trunk in every possible direction, and with several movements of the limbs as well. The arrangement of the exercises is easy to remember, because

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the first eight exercises form two series, each of which consists of three trunk movements and one deep-knee-bending. And the three trunk movements are, in each series, firstly a backward and forward movement, then a sideways movement, and, finally, a twisting. In the second series the trunk movements, and the knee-bending as well, are all somewhat more difficult than the corresponding movements of the first series.

Each of the exercises should be commenced by a full exhalation, and immediately after each exercise there should follow a short pause of rest, during which two easy and relieving full respirations, *i.e.*, two of "my complete breaths," are performed.

EXERCISE No. 1.

Full breathing during backward and forward bending of body combined with bending and straightening of both arms simultaneously.

Plant feet firmly 18 inches apart, toes turned slightly out in a natural position. Expel by a deep exhalation as much used-up air as possible from the lungs. Then immediately start slowly bending the upper part of the body and also the head, well over backwards. Whilst bending backwards, at the same time take a good, steady inhalation, and also bend the arms and clench the fists. Finish in the position shown in Fig. 19. The shoulders, elbows and hands forced well back, the wrists bent. Now, without stopping in this position, start a deep exhalation, performed during a steady forward movement, bending the body as low down as possible, until you reach the position in Fig. 20. The arms are, during the forward bending of the body, gradually straightened, the hands opened and the fingers stretched. Raise trunk and bend arms again during inhalation, and once more bring them back into the position shown in Fig. 19. Bend again forward during exhalation, and so on, performing in all four of these double movements, combined with four respirations, as full as you can make them.

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The movements should be carried as far as flexibility admits. Curve the back in order to reach further down, but keep your legs as straight as possible. By degrees you will become so pliable that you will be able to touch the floor without bending the knees.

(This exercise forms a fair preliminary movement to the Rubbing Exercise No. II of "My System.")

The Special Relieving Deep-Breathing Exercise, consisting of two full respirations without accompanying movements.

Stand comfortably, hands on the hips, and take two of my ordinary complete breaths through the nose, as full and as steady as possible.

RULES FOR INHALATION, Figs. 13 and 15 (pages 58 and 59) :

- (1) Distend the nostrils and lean the head slightly back.
- (2) Move the lower ribs as far as possible outwards.
- (3) Raise the whole upper part of the trunk.
- (4) Do not throw back the shoulders and elbows or arch the upper chest into a cramped position.
- (5) Keep the abdomen naturally relaxed.

RULES FOR EXHALATION, Figs. 14 and 16 (pages 58 and 59) :

- (1) Lower the chin again and let the ribs and the whole upper part of the trunk sink down.
- (2) Draw the lower ribs inwards and together as much as possible.
- (3) Keep the abdomen naturally relaxed.

Lady beginners and very weak male pupils should lie down flat during this deep-breathing pause and perform as many of these respirations as they find comfortable. It is better to lie on a sofa, a bed, or in a long easy chair, than upon the floor, because the repeated rising from this would be tiring. The hands should not now be kept on the hips, but the arms should rest at the sides of the body. When the complete breaths are taken in this position, the greater attention should be paid to the expanding and contracting of the lower ribs.

Ladies should be careful to remove all tight clothes and bands (corset, necklace, etc.).

EXERCISE No. 1.



FIG. 18.



FIG. 19.

EXERCISE No. 2.

One-sided full breathing during sideways-bending of trunk, combined with alternative lifting over head and stretching downwards of arms.

Sit upon a chair or stand with heels together. Perform the same preliminary exhalation as in Exercise No. 1. Then, whilst inhaling steadily bend the trunk slowly sideways to the right as much as possible. The right arm to point downwards, but the left should be raised to a half-bent position, the palm being kept as far as possible over the right side of the head (see Fig. 21). This manner of inhalation will provide an extra expansion of the left lung. Then move the trunk slowly as far as possible over to the left side, at the same time exhaling steadily and deeply. Now the left arm should be stretched downwards and the right curved over the head (see Fig. 22). This manner of exhalation provides an extra contraction of the left lung. Then back again to the position in Fig. 21, inhaling meanwhile, and, for the second time, bend over the left side while exhaling (see Fig. 22). But here you must remember to keep up the position of Fig. 22 whilst you are again inhaling, and do not start the moving back to the right side until you again start exhaling, after which you should twice repeat this pumping movement in a corresponding manner to the first two double movements, whereby you will be able to provide two extra expansions and contractions of the *right* lung also.

(This exercise forms a fair preliminary movement to the Rubbing Exercise No. 16 of "My System.")

Repeat here the *Special Relieving Deep-Breathing Exercise* (two complete breaths).

EXERCISE No. 2.



FIG. 22.



FIG. 21.

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EXERCISE No. 3.

Full breathing during twisting of trunk to alternate sides combined with arm-raising and lowering to the sides.

Sit upon a chair with the hands lightly closed or stand up, with the feet 20 to 25 (according to your height) inches apart. The toes should point straight to the front, as shown in Fig. 23. Perform the preliminary exhalation, then twist the upper part of the body slowly a quarter round to the left, at the same time raising the arms to a horizontal position, and taking a full inhalation (see Fig. 24). Immediately afterwards turn slowly back again to the position shown in Fig. 23, at the same time lowering the arms and performing a deep exhalation.

Then make a corresponding twisting to the right, once more raising the arms and inhaling deeply (see Fig. 25); then back again to the position of Fig. 23, while exhaling steadily and lowering the arms.

Repeat the movement four times to alternate sides, thereby performing four full respirations. It is wrong to twist the legs or move the feet. These should remain firmly planted on the floor during this and the other twisting exercise (No. 7); the turns or twistings being done only from the waist, the hips being fixed, and keeping so far as possible their position to the front. If difficult for a beginner to do this correctly, it is better to sit upon the floor, with the legs stretched and spread.

Repeat here the *Special Relieving Deep-Breathing Exercise*.

EXERCISE No. 3.



FIG. 23.



FIG. 24.



FIG. 25.

EXERCISE No. 4.

Full breathing during arm-raising to the front and lowering, combined with deep knee-bendings, feet apart and without heel-raising.

Stand as shown in Fig. 26, with arms stretched downwards, palms to the rear, and feet as much apart as in Exercise No. 1.

Exhale.

Raise the outstretched arms, palms downwards, slowly to a horizontal position in front, taking, at the same time, a full inhalation (see Fig. 27). Then, whilst starting a deep exhalation, sink quickly to a squatting position without raising the heels from the floor (see Fig. 28). Without any pause while in this position, rise again, at the same time completing the exhalation and lowering the arms. (It is in order to preserve the balance that the arms must be held outstretched to the front during the squatting, and they should only be lowered again during the raising of the body. If you drop them too early, you will be liable to fall backwards, at all events if your feet are in the right position, i.e., with the whole sole planted on the floor.) As the breathing is exhaled during the whole downward and upward movement, with bending and subsequent straightening of the knees, this must be carried out in a comparatively short space of time, while the raising of the arms during the full inhalation alone must be performed very slowly each time. Repeat the whole movement four times.

(This exercise is the same as the preliminary movement of the Rubbing Exercise No. 10 of "My System.")

Repeat here the *Special Relieving Deep-Breathing Exercise*.

EXERCISE No. 4.



FIG. 26.



FIG. 27.



FIG. 28.

EXERCISE No. 5.

Full breathing during backward and forward leaning of the trunk combined with tapping successively on upper chest and loins.

Whilst Exercise No. 1 was a backward and forward bending of the body to the limits of its flexibility, this *leaning* backwards and forwards of the trunk is a shorter movement, performed with a straight or hollowed back, and without moving the head independently of the body. Position of the feet as in Exercises Nos. 1 and 4.

Exhale. Lean slowly backwards, at the same time inhaling fully and tapping quickly the whole upper part of the chest with the clenched fists (see Fig. 29).

This tapping will cause the inhaled air to penetrate into certain vesicles of the lungs where perhaps it would not otherwise reach. Now lean slowly forwards without drawing in the abdomen or curving the back, at the same time exhaling deeply and tapping strongly the whole lower part of the back and loins (see Fig. 30). This tapping will tone up the kidneys and prevent lumbago. Then once more lean backwards and forwards, tapping the chest whilst inhaling and the back whilst exhaling, and so on, performing in all four double movements and four complete respirations.

(This exercise forms a fair preliminary movement to the Rubbing Exercise No. 18 of "My System.")

Repeat here the *Special Relieving Deep-Breathing Exercise*.

EXERCISE No. 5.



FIG. 30.



FIG. 31.

EXERCISE No. 6.

Alternate one-sided deep exhalation during side-bending of trunk, combined with half knee-bendings.

Stand with hands on hips and the feet somewhat more apart than in Exercise Nos. 1, 4 and 5, the toes turned slightly out (see Fig. 31). Now, whilst performing a deep exhalation, lean the trunk slowly, always facing the front, sideways over the right leg, which must be kept quite rigid, whereas the left knee should be bent as shown in Fig. 32.

Then raise the body slowly and resume the vertical position, shown in Fig. 31, with both legs straightened, at the same time taking a full inhalation. Stay in the upright posture for a moment, commencing exhalation. Then lean the trunk sideways over the left straightened leg, bending the right knee, while finishing the deep exhalation (see Fig. 33). Raise the body while once more inhaling, the right leg, at the same time, having been straightened. Pause in the upright posture while commencing exhalation, and, for the second time, lean over the right leg while completing exhalation, and continue in this way these swaying movements four times in all. The exhalations during the alternate squeezing of the lungs by means of the sharp side-bendings will provide an extra means of expelling the foul air from the lungs.

It is a mistake to bend the trunk obliquely forward instead of leaning sharply over to the sides. Remember, also, to lean the trunk over the stretched leg, never over the bent leg. But the weight of the body should be thrown upon the *bent* leg, alternately the right and the left.

(This exercise is the same as the preliminary movement of the Rubbing Exercise No. 12 of "My System.")

Repeat here the *Special Relieving Deep-Breathing Exercise*.

EXERCISE No. 6.



FIG. 31.



FIG. 32



FIG. 33.

EXERCISE No. 7.

Full breathing during twisting and leaning to alternate sides and subsequent raising of the trunk, combined with arm-raising and lowering sideways.

Position as in Fig. 34, which is just the same as Fig. 23 of Exercise No. 3.

This exercise itself is also started precisely in the same manner as No. 3: first perform the preliminary exhalation, then, while inhaling fully, assume the position of Fig. 35 (or 24). But now, instead of turning back again to the front, you should slowly lean the trunk, facing to the left, over the left leg, at the same time lowering the arms and exhaling deeply (see Fig. 36). The leaning of the trunk should be performed with the straight or hollowed back. It is a mistake to curve or bend the back far downwards.

Then lift the arms again, and raise the trunk to the position shown in Fig. 35, and twist it, without any pause, the whole way round to the position shown in Fig. 37 (or 25). Now lean the trunk, facing to the right, slowly over the right leg, simultaneously lowering the arms (see Fig. 38). Inhale while rising and twisting half way round, and exhale while completing the twisting and while leaning to the right side. Then again raise the trunk simultaneously lifting the arms (Fig. 37), and, without any pause, twist round to the left (Fig. 35), and for the second time, lean the body, fronting to the left over the left leg while lowering the arms (Fig. 36), as before inhaling during the first half and exhaling during the other half of the combined movement. And so on, performing in all four double movements and four full respirations.

(This exercise is the same as the first degree of Exercise No. 7 of "My System.")

Repeat here the *Special Relieving Deep-Breathing Exercise*.

EXERCISE No. 7.



FIG. 34.



FIG. 35.



FIG. 36.



FIG. 37.



FIG. 38.

EXERCISE No. 8.

Full breathing during arm-raising sideways and subsequent lowering, combined with slow deep knee-bending, feet together and with heel-raising.

Stand comfortably, as shown in Fig. 39.

Exhale.

Rise on the toes and raise the arms sideways to a horizontal position, at the same time taking a full inhalation. The head should be leaned slightly backwards, the fingers well stretched out, and the arms and shoulders forced somewhat back (see Fig. 40), which will improve the carriage of the whole body.

Then follows a deep exhalation, during which you should lower your body to a squatting position, but still keep the heels raised from the floor. The arms and the chin are, at the same time, again lowered, and the hands should now be strongly clenched, thus figuratively suggesting that now all the air is to be expelled from the lungs (see Fig. 41). This forms, at the same time, a good exercise for strengthening the fingers.

Now comes the second full inhalation, during which the body and arms are slowly raised until the position of Fig. 40 is again assumed. And, finally, during another deep exhalation, return slowly into the position of Fig. 39, the chin, arms, and heels being lowered simultaneously. Then repeat, but, of course, without the preliminary exhalation, the whole combined movement described above.

You will thus have performed, in all, two deep knee-bendings and four full respirations.

Repeat here the *Special Relieving Deep-Breathing Exercise*.

EXERCISE No. 8.



FIG. 39.



FIG. 40.



FIG. 41.

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EXERCISE No. 9.

Special abdominal breathing, combined with movement of the viscera.

Stand with the feet as much apart as in Exercises Nos. 1, 4 and 5.

Place the palms upon the abdomen. Exhale.

Then lean slightly backwards and draw a full inhalation, endeavouring to distend the abdomen as much as possible (see Fig. 42).

Then, while exhaling deeply, bend slightly forwards, press the hands inwards, and move them upwards, as if you wished to push all the intestines up under the ribs (see Fig. 43). Recommence the movement by raising the body and inhaling, at the same time relaxing the hold of the hands, and dropping them a little to the position in Fig. 42. Now, for the second time, press the abdomen and bend forward as before while exhaling, and then once more inhale, raising the body and distending the abdomen, and so on, performing in all four double movements, and four abdominal respirations. When the abdominal muscles, after frequent practice, have grown sufficiently strong, these movements may be performed without assistance of the hands, the drawing in and the distending of the abdomen being performed solely by the force of the abdominal muscles, as shown in Figs. 44 and 45.

(This exercise is almost the same as Exercise No. 17 in "My System for Ladies.")

Finally, repeat once more the *Special Relieving Deep-Breathing Exercise*.

Prevention is Better than Cure.

I wish expressly to emphasize the fact that it is much better, easier, safer, more pleasant, and far less expensive to *prevent* diseases, than it is to cure them. This applies especially to the great tuberculosis plague, the ravages of which would be checked if mothers or nurses would close the lips of sleeping babies, and if children were taught proper breathing by competent teachers who know how to breathe themselves, and if parents and guardians would be on the look out for adenoids. When the presence of these is suspected, the children should be sent for examination, and, if necessary, for surgical operation. The consumption germs would then disappear, not having a suitable soil in which to settle.

EXERCISE No. 9.



FIG. 43.



FIG. 42.



FIG. 14. CORRECT POST FOR ABDOMINAL EXERCISES. FIG. 15. CORRECT POST FOR ABDOMINAL EXERCISES.
FIGS. 14 AND 15. FROM "POSTURE" BY

PART III.

CHAPTER 1

HINTS FOR ATHLETES

So many English athletes frequently incur trouble with the heart because no attention is paid to proper breathing during athletics and rowing, and they are also very liable to catch chills because they do not know how properly to work the respiratory organs, and also because the development and hardening of the skin (by air bath and sun bath, combined with skin massage) is almost unknown in this country.

Any first-class English trainer in boxing, sculling, lawn tennis, etc., will—I speak from personal experience of myself and my family—teach you very carefully, and with the finest details, every technical movement or trick of the game, but he will not tell you how to breathe to the fullest advantage for your health or for the particular game. He will not aid you to transform your skin to a healthy and strong working organ, probably because he has personally not given much thought to these matters; but I contend that these are essential both for the health and the well-being of the individual, and also for success in any athletic career.

There are two things English athletes must learn in order to retain their supremacy in the world—the one is correct respiration, and in this connection I have done what I could by writing this booklet on breathing, with special hints for almost every kind of game, and it will be published in this country long before it is printed in other countries. The other point is how to get proper health and development of the skin, which will be a little more difficult for athletes to acquire in England where air and sun bathing places are

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almost unknown and where the influence of fashion is so powerful.

Of course, some progress has been made during the last century, e.g., the cricketer has dropped his top hat, but I fancy a lawn tennis player or an oarsman would fear just as much to enter a church naked as to appear upon his ground or boat dressed only in a swimming belt, even if the sun were shining ever so much. It is considered as shocking if an amateur in a sleeveless jersey rows or sculls on the Thames.

What an outcry there would be if a crew appeared with no jerseys on at all, as is often the case on the Sound, the lake of Zürich, or elsewhere on the Continent outside France ! But such crews, after a few weeks' practice in the sun, would look quite properly clad in their dark brown skin.

When Continental oarsmen and scullers have mastered the English style and technique, the *Copenhagen* and *Grasshopper* crews, and the big *Sinigaglia*,* will be very formidable because they are healthier than the English. They have listened to the advice of the hygienists, and understand the proper use of fresh air and sunshine.

For Sprinters.

During the run itself there should be a minimum of respiration, but before and immediately after a maximum should be indulged in. Many sprinters hold their breath whilst they are down on all fours, waiting for the shot or word of command from the starter. This is a great mistake. Breaths as complete as possible should be taken. When "Are you ready?" has sounded, a very full inhalation should be taken, and on "Go" a steady, slow expiration started, which should last for as much of the 100 yards as possible.

* This was written before the great Italian sculler won the Diamonds at Henley. Unfortunately, he was killed in the war.

If you can run the last bit without breathing at all, so much the better. If not, you should take only short gasps through the mouth, because full inhalations will check the pace of a sprinter.

Sprinting is a great strain upon the heart and lungs. Therefore, as soon as the winning post is passed, one should carefully take as complete respirations as possible, hands on hips and body erect, just as described in the chapter on "My Complete Breath." During the first few seconds you will perhaps be obliged to keep the mouth open, but as soon as you can restrict yourself to nasal breathing, the better. Sprinting is not a good exercise for the respiratory organs and the heart. This sport ought, therefore, only to be indulged in by persons with thoroughly sound organs, and every sprinter ought to strengthen his lungs and heart, and keep them fit, by daily nasal deep-breathing exercises, combined with body movements.

For Middle-Distance Runners.

Both in the longer sprinting distances (120–350 yards) and in the middle distances there is so great a need for air that most athletes are here obliged to keep the mouth open and use it, together with the nose, as passage for the air. But it should be regarded as a makeshift, and ought never to become a habit when running slowly, or on ordinary occasions. When leaving the starting mark the runner should immediately begin to pump as much air as possible into the lungs, even more than he feels he immediately needs. If he omits this precaution, there will soon come an instant where he will find himself very short of air. The middle distances are a still greater strain on the heart and lungs than the 100 yards. My remarks above, on the necessity of having sound organs, and of strengthening these by

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other effective exercises, are, therefore, still more appropriate here.

For Long-Distance Runners and Quick-Walkers.

These groups of athletes ought to develop a regular, deep nasal respiration not alone in daily life, but also when they are indulging their particular sport. Their running or walking sport itself will then become a splendid exercise for the lungs and the heart, as distinguished from the short and middle distances. A certain number of strides should be taken during inspiration (say three or four) and the same number during expiration. Here it is a question of racing or of keeping almost the same speed as in racing, where a quick change of air in the lungs is needed, and must not be confused with the special exercise of deep-breathing performed during ordinary walking, which is explained on p. 18.

An athlete who trains himself to be capable of breathing regularly in long distances will not only thereby strengthen his respiratory organs, but he will greatly increase his stamina and staying power. There is still another reason why long-distance athletes ought to use nasal breathing exclusively. The damage which may ensue from inhaling germs through mouth-breathing during the few seconds or minutes of short and middle distances may never be considerable. But hours spent in this way, especially in the dust of the high road, are certain to be most harmful. Long-distance athletes who can only with difficulty get enough air through the nose must exercise their nostrils as explained on p. 26.

For Speed-Skaters.

There are two things which tend to make speed-skating a healthy pastime. Firstly, it is as a rule performed on the

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ice, in nice, fresh air free from dust. Secondly, the rhythm of the movements simply leads to the performance of a regular deep respiration, inhaling when resting upon the one skate, exhaling when upon the other. And I have found it most convenient to inhale whilst the right leg slides, and exhale upon the left. The reason for this is that the right leg will always be the outward leg in the curves; and, if these are made in correct style, the upper part of the body will rise a little every time the right skate is *trailed* upon the ice into its position in front of the left foot, whereas the body will sink further downwards when the weight in turn is thrown upon the left leg.

The lower the temperature is the more necessary it will be to keep exclusively to nose-breathing.

For Boxers and Wrestlers.

A boxer who adopts correct breathing methods will not only greatly improve his stamina, but will also by this means strengthen the more vulnerable parts of the body, which will make him less liable to be knocked out.

A boxer should respire regularly and deeply through the nose during the whole round. If he holds his breath when making specially severe efforts, he will soon get out of breath. And if he respire through the open mouth, he runs the risk of biting his tongue, and, what is much worse, the blows he gets on the jaw will hurt him severely. But when the teeth are clenched and the muscles of the jaw contracted, he can withstand much more punishment. Of course, it is not necessary to keep these muscles braced the whole time. But when the mouth is shut, the jaw can be set as quick as lightning, and quite instinctively whenever a blow threatens.

It is important that the boxer keep breathing regularly

and deeply while ducking, bending, crouching, side-stepping, and during all other quick movements of the body. The slow rhythm of the breath must be quite independent of whatever else he is doing. The severest degrees of Exercises Nos. 2, 5, 16, 17 and 18 of "My System" and the last half of "The Daily Five Minutes" form splendid training for this purpose, the quick trunk movements, when performed at a rate of at least four double movements during one complete respiration.

As long as the body is out of reach, the boxer should respire as nearly as possible according to the scheme of my complete breath, taking full advantage of the costal breathing. But as soon as it comes to close quarters, the boxer must brace the whole abdominal wall in order to protect his stomach, and, above all, the solar plexus. If the upper part of the straight abdominal muscles are in a state of softness and the ribs relaxed, a blow in this region will go through and do damage. But if these muscles are thick, strong and hardened, and the ribs fixed, a severe blow can be taken here without much harm. Almost every athlete understands how to brace these muscles and fix the lower ribs. But nine out of ten will, at the same time, hold the breath. Now, it is obvious that, if a boxer holds his breath for several seconds and repeats this performance frequently during a round, he will very soon be out of breath. And if he, gasping for air, relaxes the abdominal wall then he will easily be knocked out, or, at all events, be hurt severely if he is hit on the mark. He must, therefore, learn how to keep a regular breath going, even when the abdominal muscles are braced and the lower ribs thereby completely fixed. It is somewhat difficult to breathe under these conditions, because it is quite impracticable to move the lower ribs. The only possible form of respiration in this case is, then, a combination of clavicular and diaphragmatic breathing, which must be

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practised until it can be performed unconsciously. I have never seen this fact mentioned or explained anywhere, but I suppose there are, or have been, champions who quite instinctively did this. I do not think I can better illustrate the importance of this method than by giving an account of my first meeting with Bombardier Wells. It was a short time after his defeat by Carpentier that the English champion called upon me, accompanied by a mutual friend. They were somewhat depressed, and they wanted me to try to find out what really was amiss with the Bombardier. They told me that one expert had said that he suffered from a sort of nervous indigestion, that somebody else had told them about a mysterious disease in the region of the solar plexus, with more of that sort of thing.

I asked him to strip. I have seen and studied thousands of men naked—for thirty years it has been one of my hobbies. The numerous sea-bathing places of Scandinavia and the crowded air-baths of the Continent, where people do not wear any clothing, have given me rich opportunities. At the first glance I saw what nonsense had been written about the Bombardier's famous waist-line. How often have I not read that this part of his body was too long, or that it was too weak for a boxer. But now I was able to ascertain for myself that his waist and trunk are unusually short. It is his very long thighs which make him so tall. As to the imaginary weakness of the Bombardier's waist-line, I can assure my readers that only once in my life have I seen a man with stronger or more beautiful muscles round the waist.

I examined him, let him breathe fully, etc. I saw he could brace his abdominal muscles until they were as hard as steel, but I also saw that he was holding his breath while doing so. Here was the Bombardier's weak point, then; he admitted that he was soon out of breath if he braced these

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muscles while in-fighting, and he also admitted that they had been quite relaxed when he received Carpentier's body blows. I then explained to him the method of regular breathing with braced waist-muscles, and the best way of learning and practising it. I told him how to perform certain movements of "My System" in an extra severe degree, above all, Exercise No. 6, with very slow leg-circling and with heavy boots or weights on the feet. This exercise specially strengthens the muscles guarding the solar plexus, and, when combined with the prescribed deep breathing, it produces the ability of respiring during the fixation of the lower ribs and the contraction of the above-mentioned muscles.

It is interesting to note that it was just this leg-circling exercise of mine that contributed so much to the improvement of the British Champion for the time being. When the Swedish translation of "My System" appeared in 1906 it was severely criticised, and I was called a charlatan and an ignoramus by the representatives of the Swedish gymnastics. Above all, the principal of the Central Institute in Stockholm, Professor L. Törngreen, wrote long condemnatory articles in certain papers. It was my Exercise No. 6, especially, which he declared ought to be entirely rejected, because it was a physical impossibility to breathe during its performance. Which affords a good example of how conceited certain public authorities are, and how stupid, even when dealing with their own special subjects.

I also showed Wells another good exercise for practising this method of breathing with ribs fixed and the abdominal wall braced. Lying upon my back on the floor, I let him stand upon my "stomach" for a rather long time whilst I continued the regular respiration. And I further explained to him how it was possible to sit in a chair, or in a railway compartment, and practise this combined clavicular and

diaphragmatic breathing during voluntary contraction. It should be done for two or three minutes at a time by the watch. He persevered diligently with these exercises when preparing for his next contest, and astonished everybody with the speed and stamina he displayed on that occasion. But since then, I have cause to believe, he has totally neglected these breathing exercises, for what reason I know not, and his subsequent failures are, therefore, easy of explanation.

Several of these hints will also be useful for wrestlers, more for Græco-Roman than for Catch-as-catch-can exponents ; but most of all for Cumberland and Westmoreland wrestlers, who are forced to stay at close quarters for long periods, often with several muscles of the body contracted.

For Swimmers.

Most other sports and games can be performed, even records be beaten, without special attention being paid to correct breathing. The harm done to the heart may only be detected some long time after the "records" have been declared and published. But in swimming it is quite another matter. It is quite impossible for a swimmer to do anything until he has learnt a convenient method of breathing. It is really a part of the game itself, which necessarily must be studied as early as the movements of the limbs. It follows that every expert swimmer knows how to breathe when in the water, and my hints on this special subject will thus be only of use to beginners. In all styles air is inhaled quickly through the mouth, and exhaled slowly through the nose under the surface of the water. Mouth breathing is, perhaps, not so harmful as on shore, because of the absence of dust ; but, in a London swimming bath, it must be borne in mind that the air is apt to be foul, which makes it the

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more necessary that when not in the water swimmers should acquire the habit of the more hygienic nasal breathing.

Beginners often feel out of breath, although they think they have kept the mouth wide open. They should endeavour to open the mouth as wide as they comfortably can, or even a little more in order to get sufficient air. It is also a common error to raise the head, or to bend it sideways, in order to keep the mouth clear of the water. It should only be turned, the neck being twisted. If a swimmer doing the breast-stroke bends his head backwards to inhale, or when doing the side- or overarm-stroke, he lies on his right side and bends his head to the left, thereby raising it above the surface, his legs will immediately sink and the pace suffer. In the crawl it is, of course, still more important not to raise the head, because the very principle of this stroke is to keep the feet above the water, acting against the surface.

Swimming under water should only be performed by strong and well-trained individuals, because it is an enormous strain upon the heart and lungs. Just before plunging, the lungs should be filled by a full breath after my method, and the air is only gradually exhaled in small quantities at a time while swimming.

For Oarsmen and Scullers.

Some readers will deem it strange that I draw a comparison between two such apparently dissimilar sports as rowing and speed-skating. But in some points both of them are specially healthy forms of exercise, because they are ordinarily performed in fresh, open air, and because it comes quite naturally to breathe regularly and deeply during the performance. The reason for this is that the time of the movements in rowing and in speed-skating is not only generally regular, but also of about the same length; that is, the double movement of a rowing-stroke (the pulling and the



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leathering) will, in most cases, last just as long as two strides (one with each leg) on the skates. And both the complete rowing-stroke and the double skating-stride will, again, last just as long as an ordinary complete respiration (consisting of inhalation and exhalation). Furthermore, if the time of the movements is accelerated, the harder work of the greater speed will naturally require an exactly corresponding increase in the measure of the respiration, because more air is needed. I think it is impossible to name a third sport or game in which the movements correspond so precisely with a convenient breath. In all other cases the movements are either much quicker or much slower, or quite irregular.

Another resemblance is in the work of the legs : a sudden and energetic pushing away of the body's weight, using the whole flat of the foot as basis. Certainly, in the one case, only one leg is used at a time, in the other, both legs simultaneously. But it is a fact that muscles well trained in one of these sports are highly useful for the other. Further, the big back muscles (*latissimus dorsi* and *erector spinæ*) are very much used both in towing and in speed-skating. The lower part of the back is generally the only point where beginners in both sports suffer from swollen and sore muscles. But the consequence is that back-muscles well trained by rowing will much more easily stand the strain of speed-skating, and *vice versa*.

I have raced in all sorts of boats for over thirty-four years. For more than ten years I stroked the Scandinavian Champion Fours. I am sure the main reason for our continual success was that I had taught my crew how to breathe while rowing. And, every time we were lying in wait for the signal to start, the last thing I asked my comrades to remember was to breathe deeply both then and also during the first strokes. I presume that our competitors must have held their breath from sheer nervousness during the first five or

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six strokes, with the result that before half a minute had passed, they were out of breath, and could not recover it for a few minutes, by which time we had usually got ahead

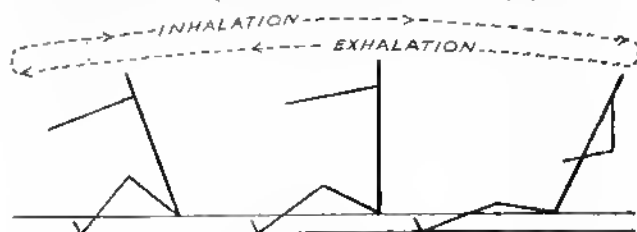


FIG. 47

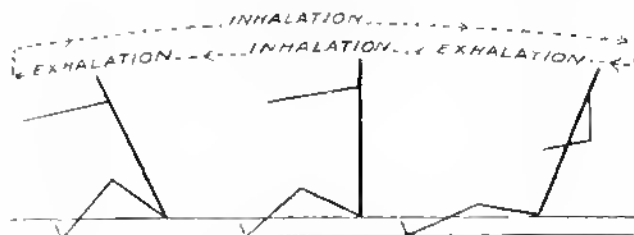


FIG. 48.

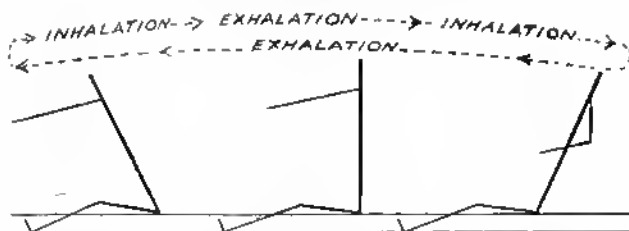


FIG. 49.

by one or two clear lengths. Besides which I made another rule, in order to be sure that both lungs and heart were in good working order just at the moment of starting. While our competitors were always very careful to economise their strength by paddling out to the starting post, I used

to set a rather quick stroke, putting a little more than half power into it. And I always went a few hundred yards past the starting-post before I turned ; and we then made one or, if the first failed, two starts in the direction of the course. Then we rested awhile, preparing ourselves and applying resin to the palms of our hands. I was careful that this rest should not last so long as to deprive our bodies of the warmth and our lungs of the elasticity gained by the smart row to the starting-post. If we were a little too early, I would, therefore, make one more start, only five strokes, of course. These preliminary short starts before the real one, and under the same conditions of wind or stream, are very useful. I think most rowing athletes have experienced that when practising starts, the second or the third will always be much more successful than the first. The first time I started as member of an Eight upon the Thames, we paddled up against a very hard stream, and had to race back with the stream. I, therefore, recommended our stroke to make a trial start with the stream. I think it would have proved useful especially for people who had never before started together. But he did not do this, so I supposed it was not the custom here in England.

Now, as to combining the time of the stroke with the measure of respiration, I make it a general rule that only one complete respiration should be taken during a complete stroke (pull and recovery), when the time is slow and no great exertion employed, and always when the time is very quick ; whereas two respirations may be taken when full force is used without the stroke being quick. The reason is that the requisite amount of air depends more on the force applied than on the rate of strokes. If a quick stroke lacks energy it will not give so much speed nor cost so much effort as a slow stroke with a more energetic pull. What, in this connection, should be deemed a " quick " or " slow "

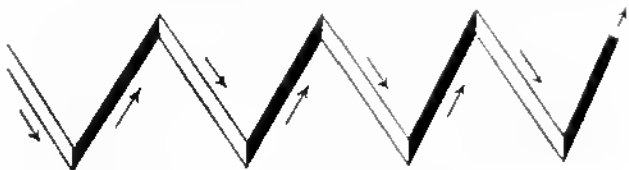
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stroke depends, of course, a good deal on the kind of boat. For instance, in a sculling "best boat" a time of less than 24 may be reckoned as slow, in a "four" the limit would be rather about 26, and in an eight as much as 28.

Then there is the question of *when* to inhale during the stroke. The main principle should be to perform inhalation when the trunk swings backwards, and exhalation when it bends to the front. Some special styles necessitate small deviations, but the principle is generally correct. The reason is that a free position in the backward swing favours the abdominal part of the full inhalation; while the bent or even crouched position in the forward swing favours the corresponding part of the exhalation. I must admit that I have both seen and heard the exactly opposite method recommended. As an argument it was propounded that the hard water work was performed during the backward swing, hence it was wrong to inhale simultaneously. It was much better to sit during the easy work of feathering! Of course, I do not agree to this, but I know very well how this misunderstanding arose; I have met scores of athletes and sportsmen who paid attention only to inhalation, scarcely realising the existence of exhalation, which in reality represents—or ought to do—quite as great amount of physical work as inhalation. The above-mentioned simple rule of the distribution of breath in the stroke is illustrated in Fig. 47, and by the curve A in Fig. 50. It should be applied in light rowing gigs and outriggers (pair-oars, fours and eights), always when the rate of stroke is quick, and also when paddling at a slow pace. But, if in these boats, a hard pull is combined with a slow stroke, an extra inhalation should be taken in the middle of the quiet recovery, while, of course, an ordinary inhalation is taken during the short vigorous stroke (see Fig. 48 and curve B of Fig. 50).

In very heavy rowing gigs, and in ordinary broad sculling

downward=Exhalation



Curve A.



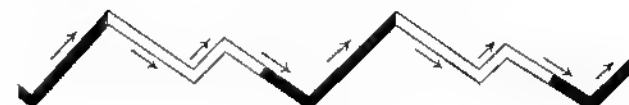
Curve B.



Curve C.



Curve D.



Curve E.



Curve F.

skiffs with fixed seats, it is also recommended to take two respirations per stroke if full speed is wanted. But here the extra inhalation should be taken during the pull, because this is, by necessity, long and rather slow, while the recovery is quick (see Fig. 49 and curve C of Fig. 50). Still other modifications are useful in sculling "best boats." Curve D of Fig. 50 shows the best way of respiring during a quick stroke with hard pulling, and always when paddling. As will be seen, here again, as in Fig. 47 (and curve A), we have only one complete respiration to one stroke with its recovery, but the distribution is different. Curve E shows the most correct manner of taking two breaths per stroke when sculling with a slow rate of stroke, but with full force. The next best method—and much easier to learn—would here be to take one complete breath during the pulling and one during the feathering (see curve F of Fig. 50). All these directions seem, perhaps, somewhat circumstantial. But I assure you that each method is acquired with a week's practice, and afterwards performed quite subconsciously. And please remember that a regular, correct respiration signifies less waste of energy and, therefore, greater stamina.

The air should, of course, as far as possible, be drawn through the nose alone. If, in a very hard race, it should be necessary to breathe also through the mouth, care must be taken that the respirations are not less deep. If breaking down, do not fall forwards, but lean backwards and breathe deeply!

CHAPTER II

HINTS FOR SINGERS AND SPEAKERS.

SINGING and speaking are in a great measure physical work. It is, therefore, obvious that the sounder and better developed the physique is, the more advantageous will be the conditions for good singing and speaking. It is the strength and endurance of the organs directly engaged during singing and speaking which is of the greatest importance. Therefore, the muscles which move the tongue and vocal chords ought to be developed by special exercises, and the vocal chords themselves too, because they consist of muscles. The air exhaled from the lungs being also a productive agent of the voice, it is clear that the lungs ought to be well-developed before singing is attempted. And the abdominal muscles being an important factor in controlling exhalation, and therewith the voice, all vocalists ought to develop the strength, endurance and mobility of these muscles. It is no wonder that most singing masters on the Continent recommend—some masters even exact—that their pupils should perform "My System" (15 Minutes' Daily Exercise), because they know by experience that it is the best existing means of strengthening the abdominal muscles. The exhaled air, controlled by strong and braced abdominal muscles, can then be utilised at will for the sustaining of a very prolonged note, which can be kept at the same level of pitch and tone, or made to swell or diminish according to requirements.

The lungs are also highly developed by "My System," "The Daily Five Minutes" or by the "Breathing System" explained in the present volume. All would-be singers and speakers ought, therefore, to practise it. My methods will



Fig. 51.

Showing the position of the arms in the supine position.



Fig. 52.

Showing the position of the arms in the supine position.

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be found invaluable from the point of view of increasing the range of extensibility of the muscles of respiration, thus rendering the chest more flexible. The vital capacity does not depend upon the size of the chest, but upon the mobility of the chest walls and the elasticity of the lungs, which are greatly increased by my free and breathing exercises, and also by good sports (such as rowing), when performed with strict attention to proper breathing. It is the difference between the circumference of the chest after a full inspiration and after a deep exhalation which tells. I have met some of the "strongest" weight-lifters in the world, who have yet died when about forty years of age. They had a chest measurement of about 50 inches, but an expansion of only $\frac{3}{4}$ or 1 inch, whereas several famous singers or first-class rowing men could show an expansion of 10 inches, even if their greatest chest circumference be only 45 inches.

I have perused scores of English and German manuals on "The Art of Breathing for Voice Production," or under similar titles. One advocated special abdominal breathing; another only clavicular breathing; a third, a lateral costal method; a fourth, respiration with the back; a fifth, a hysterical female singing teacher, recommends deep sighs! and so on. All of which is nonsensical, and must have done a great amount of harm, directly or indirectly, by preventing students from learning a good method. Even the London County Council's "Syllabus of Graduated Instruction in Singing" is full of errors.

The best way of inhaling while singing is that prescribed in "my complete breath," with the exception that it must always be performed quickly and through the mouth, and, further, it is of course, not always possible to rest the hands on the hips (which position makes the raising of shoulders and upper chest easier). The reason why the breath must here be inhaled through the mouth is not only that it can

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thus be performed very quickly, which is often necessary, but it is really a mistake to inhale through the nose while singing, because the back of the tongue will then rise and partly close the throat, and the note produced will take a nasal twang.

Exhalation, on the other hand, is, of course, performed quite differently to the method advised in "my complete breath." The elastic force of the expanded chest should be held in check by the contracted, or rather braced, abdominal muscles. Certainly it is impossible to prevent the ribs from sinking somewhat at the moment when the abdominal muscles are contracted. But after this the chest should be allowed to sink only gradually, and the volume of air in the lungs can thus be controlled at will by the momentary relaxation of the abdominal muscles, and can be emitted forcibly or gently, but always slowly. Fig. 51 gives a front view and Fig. 52 a side view of the right pose immediately after completed inhalation. The abdominal wall is very slightly retracted, the muscles being only braced, not drawn inwards, and the lower ribs fixed. I will take this opportunity of pointing out that "drawing in" and "bracing" of the abdominal wall are two quite different things. This wall may be voluntarily either relaxed or braced in any position between the fully distended and the completely retracted.

It is, of course, important to use as little air as possible in order not to make the sound breathy, in other words not to have "breath escape," and, until the student has learnt how to do this automatically, he will never become a good singer or speaker.

This method was used by the old Italian singing masters for more than 150 years. But in 1855 it was rejected by the French author, Mandl, who, in England, was followed by Lennox, Browne and Behnke. Mandl recommended the

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abdominal method of breathing, in that he maintained that the distending of the abdomen would facilitate the " flattening " of the diaphragm and thereby increase the capacity of the lungs.

After all, I am sure that the old Italians were right, only their method has been misunderstood. I do not think that they advocated contraction of the abdominal wall *during* inhalation. It is more likely than not that they advised contraction only *immediately after* inhalation. Personal practice will show to anyone that it is quite possible to brace the abdominal muscles after a complete inhalation, letting the ribs sink a little, and even to retract the abdominal wall considerably without letting the slightest amount of air escape. It will only be compressed, but that is just what is necessary for the production of a good note—that the pressure of the inside air is stronger than the atmospherical pressure. When the right moment arrives, the glottis opens, and the sound produced is fuller on account of the greater density of the air, owing to its compression.

On January 15th, 1910, a conference was held at the University of London, and a sub-committee was appointed to inquire into the present-day knowledge of the voice and speech training, in order to ascertain the scientific basis upon which speech training should be conducted, and what agreement exists in first principles.

The sub-committee undertook to investigate normal healthy breathing in relation to speech. With consent of Dr. Pasteur, who acted as chairman on the sub-committee, the report was published in the *British Medical Journal* of August 30th; the reason given for its publication being its likelihood to be of interest to medical men, teachers and other persons.

The committee appear to have taken great pains to describe ideal breathing for the voice: and add that such

ideal breathing should bring every part of the lungs into activity.

But, unfortunately, the method of breathing advocated by the committee makes it a physical impossibility to bring every part of the lungs into activity.

For, if there is to be a full inflation of the lungs, the chest must be fully expanded in its three diameters; but if there is to be—as the committee suggest—"the hardening of the abdominal walls which checks the outward bulging," it is impossible to expand the lower ribs. There must be no "check," no "hardening nor any drawing inwards of the abdominal wall," if the lungs are to be inflated at their bases, which is most important, as the lungs are broadest here. The correct method of breathing when the best vocal effects are desired, to say nothing about healthy breathing, is the concerted and harmonious action of all, and not part, of the respiratory mechanism.

Just in order to counter-balance the eventual damage caused by mouth-breathing during singing, it is for vocalists of the highest importance that they acquire the habit of exclusive nasal breathing during physical exercises, and always in daily life when they are not cultivating their talent.

It is admitted on all sides that consumption is associated with all forms of poor breathing, and it is a terrible thing to contemplate that inadequate methods of breathing are daily being taught in our schools; and especially so when one generation of correct breathers would reduce consumption to a minimum.

It wearies and sickens one to think that the great masses of humanity are cut off, in early childhood and ripe manhood, by a disease which can be minimised if the whole mechanism of respiration were employed. Close observation and long experience have proved to me that the majority of my fellow men breathe superficially.

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